

**Pedestrian Priority Zones in the Context of Urban Mobility and
Valorization of Public Space**

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ABSTRACT

KEYWORDS: pedestrians, zone 20, zone 30, traffic calming, Baixa, shared space.

Present work is dedicated to pedestrian priority zones and traffic calmed areas in urban agglomerations.

Since the end of the Second World War cities have been experiencing major changes in urban structure due to the boom of automobile use which partially was responsible for urban sprawl and created a new type of demand to which traditional city centers could not respond. Decay of historical centers was observed in many European cities, being aggravated by traffic congestion, noise and air pollution. In this context, the concept of pedestrian street appears as a response to complicated traffic circulation in historical areas, promoting multiple uses a street can offer, for example, a playground for kids, an area for walking or running, etc. These activities are hardly compatible with high speeds, so in this case speed limits of 30 km/h and 20 km/h are frequently applied. Zones 20 and 30 are able to introduce significant changes in commercial trends (in the commercial structure), ease problems of air and noise pollution. Some of these issues are present in Baixa, an area in central Lisbon, also affected by automobile use. Recent decay of the area is still visible on some streets, however, Baixa manages to attract large number of people, especially tourists. Still, a number of problems remains. Introduction of a shared space concept on Rua Augusta might be a partial solution to them. This paper aims to understand whether and how pedestrianization project in Baixa may be developed.

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INTRODUCTION

“There is more to life than increasing its speed”

(Mahatma Gandhi)

The second half of the XX century was marked by a great increase in the number of people living in cities. Urban agglomerations became poles of attraction for migration flows and these phenomena, coupled with growing car-ownership rates, resulted in the fact that modern transport systems are characterized by large number of users and traffic modes. The necessity to organize these complex systems and to provide space for different traffic modes changed the way cities look. Urban areas had to cope with traffic flows, and as a result nowadays typical street pattern consists of a road for motorized vehicles, a cycle lane (in some cases), pavement for pedestrians, parking and a range of crucial signage to facilitate navigation and make mobility more secure. However, this type of street organization may not be desirable in certain areas, more specifically, in the city centers.

Downtown areas have always been places where economic, leisure, social and other types of facilities are concentrated, not surprisingly, they often attract large number of people and this frequently results in traffic jams, air and noise pollution, thus creating unpleasant environment. Besides, excessive traffic signage in central locations can harm the image and perception of a place, this relates in particular to historical centers with architectural heritage.

The creation of pedestrian priority zones aims to reduce traffic levels and revitalize particular urban areas, making them safer and more attractive for recreational use. Basically, this approach suggests certain transformation: a street used mainly for mobility purpose turns into a place of attraction which offers nice environment and where people come to spend time with pleasure. Thus in certain areas car-users are obliged to give priority to other transportation modes, especially pedestrians, besides, strict speed limits

and street design aimed to slow down automobile speed and reduce parking lots makes driving complicated. These measures make an area more livable, reduce the levels of traffic congestion and accidents rate. Pedestrians like walking in such zones because they feel less stressed and more secure, at the same time their perception of distance changes: feeling more relaxed they start to consider their walk as a pleasant journey so they are more likely to make longer walking trips. Naturally, when an area is widely used by pedestrians, street commerce and cafeterias flourish, providing economic benefits for the neighborhood as well.

Increased number of pedestrians, cyclists, children and sellers on a street makes it safer as there are many observers of street life and the possibility of crime is less than on an abandoned site. This phenomena was well described in the book of Jane Jacobs, "The death and live of great American cities", (Jacobs, 1961): "So far as security is concerned, nothing will have changed except that the opportunity for street crime will be a little easier, if anything, because of the added emptiness"

However, there is a number of concerns that installation of pedestrian priority zones may provoke, but they are varied according to the type of each zone. Normally, fully pedestrian streets, zones 20, zones 30 and shared spaces are distinguished, each having their own features, potential and effects on urban life. Fully pedestrian malls which are opened for pedestrians exclusively are relatively rare, in the majority of cases these areas provide decent walking environment but are also used by private vehicles and public transport. Still pedestrian priority zones introduction changes the way a street is used and has certain impact on local transport system.

In addition to that, it is important to consider the concept of "shared space", a recent trend in urban organization which suggests the creation of locations without traditional traffic signage. In this places, people move with the help of intuitively understandable urban design and human interaction. The idea of a shared space, considered dangerous in the beginning, is supported by the fact that people left without proper signage feel more responsible for their actions and tend to slow down and behave with more caution. Shared space, as indicated in the name, is used by all means of

transport, however, areas for different transport modes are not delimited in a traditional way, on the contrary, they are less visible and this is how shared space promotes integration, rather than segregation, between users.

To sum up, the concept of pedestrian priority zones is particularly important nowadays since many cities are searching for the way to reduce traffic congestion, noise and air pollution and achieve sustainable development. They also play a relevant role in valorization of urban spaces, providing more comfortable and friendly environment for the citizens. Thus it is interesting to develop this topic and learn impact and consequences of introduction of pedestrian priority zones.

METHODOLOGY

This paper is dedicated to analysis of the variety of pedestrian priority zones, the advantages and disadvantages of each type, prerequisites for their introduction and the impacts they produce on the territory.

The research objective is to explore the influence of pedestrian priority zones on local traffic and public space. More precisely, this paper is to show how different types of these zones modify urban environment. The initial hypothesis is that pedestrian priority zones provoke traffic reduction and decrease in the levels of congestion, at the same time favoring commercial and recreational street use due to the rise in the number of people walking in the area. There is a number of means to achieve this research's aim, so this chapter is dedicated to the methodology applied during the research.

Indirect methodology of data collection includes bibliographical research, analyzing video documentaries, images and cartography exercise, aimed to better illustrate pedestrian malls in Baixa. Observation and analysis of images is necessary to evaluate street design and signage in the considered area. Direct methodology consists of

interviews conducted while working on the case study of Baixa area, observations and counting of jaywalkers on the street.

General bibliography includes some major books dedicated to public space and urban traffic. It is important to highlight that the development of the concept of pedestrianisation has always been extremely influenced by major architectural theories and ideas, and the way streets are pedestrianized, their design and organization depend greatly on the urban planning practice applied in a particular period of history. For the same reason it is necessary to analyse some major studies dedicated to urban traffic and transport systems: in the course of time travelling patterns and transportation modes were changing, and pedestrianisation was changing as well. Some of the most important works studied during the research are provided below.

Jane Jacobs, "The Death and Life of Great American Cities", 1961

This famous book is primarily dedicated to the evaluation of comfort in the cities and what makes certain areas more friendly and livable than others. Issues of safety, city neighborhoods their functions, mixed uses of streets, parks, city design, concentration (not living on dispersed areas)

Edward Relph, "The Modern Urban Landscape: 1880 to the present", 1987

In this work Edward Relph provides a profound research of urban landscape and its evolution from the end of the XIX century until nowadays, analyzing the changes that were introduced in the course of time and the impacts which major architectural ideas produced in the cities.

Specific bibliography is mostly represented by scientific articles elaborating the theme of different types of pedestrian priority zones, differences between them and the outcomes of their implementation in some cities. Various case studies are also making part of this category. Besides, guidelines developed by transport research centers and local authorities are included as well.

Among these it is relevant to mark out “Guia para a elaboração de planos de mobilidade e transportes”, made by Instituto de Mobilidade e dos Transportes Terrestres, which contains brochures dedicated to pedestrian infrastructure and traffic calming.

The paper is to be structured in the following way:

- Chapter 1: Evolution of pedestrian priority zones
 - 1.1 European and American tradition of pedestrian priority zones
 - 1.2. Evolution of the concept of pedestrian priority zone
- Chapter 2: Types of pedestrian priority zones
 - 2.1 Prerequisites for the installation of pedestrian priority zones
 - 2.2 Zones 30, zones 20 and shared space (difference between these types and the effects produced, critics, examples, signage)
 - 2.3 Traffic calming measures frequently applied in pedestrian priority zones
 - 2.3 Shared space (examples, critics, design principles, difference in effect produced)
- Chapter 3: Consequences of pedestrian areas’ installation
 - 3.1 Impacts on local transport system
 - 3.2 Impacts for the environment (air and noise pollution)
 - 3.3 Impacts on the community (security concerns, impacts on the retail trade and local lifestyle, especially leisure activities)
- Chapter 4: Case study: pedestrian priority zone in Baixa
 - 4.1 General information about the area of Baixa
 - 4.2 Municipal politics in Baixa
 - 4.3 Proposals for Rua Áurea

The first chapter is to be mainly dedicated to the history and development of pedestrianisation after the Second World War, in Europe and North America in particular.

Due to historically different conditions, the approach to pedestrianisation was not the same: for example, narrow streets which make up a complex system of historical centers in many European cities are different from more organized and planned American cities. Besides, consequences of the war were much more evident and destructive for European cities. Since initially circumstances were not the same for the two continents, pedestrianisation process had specific features in each case and for a broader research it is necessary to analyze both. At the same time, the view on street organization has slowly been changing as well: instead of strict segregation of various means of transport, their integration has been promoted what was reflected in the emergence of a shared space concept.

The second chapter is to show which areas are more suitable for pedestrian priority zone installation. A variety of pedestrian priority zones was developed to better address different types of urban areas, for example, a full pedestrian mall may be applicable to the city center but is not the best option for residential areas. Thus the second chapter analyses the differences between types of pedestrian priority zones, their positive aspects, main features and design principles.

Impacts of pedestrian priority zones implementation, which are divided into three groups, are to be studied in the third chapter. Impacts on local transport system cover issues of traffic congestion, accidents rate, etc. Impacts on the environment include noise and air pollution. The last sub-section, dedicated to the effects of pedestrianisation on the community, will cover the topics of sustainability, retail trade, leisure activities, etc.

Finally, the last chapter is the case study of pedestrianisation in Baixa, Lisbon. This case is an interesting example due to central location and importance of the area and the design applied, which is a mix of full pedestrian malls with streets opened for the traffic. The area is extremely popular among tourists, however, it is worth considering the reasons why Baixa attracts other people, especially inhabitants of Lisbon Metropolitan Area. Consequences of pedestrianisation project in Baixa are described in this chapter, with particular attention to the impacts on the traffic system and local community. Data is to be collected by conducting interviews with local and municipal authorities as they are

well informed about past and current situation in Baixa and can give their professional opinion concerning traffic scheme implemented in the area. Besides, they are generally aware of future plans and strategies which may be introduced in Baixa. Due to the theme of this work, representatives of Lisbon City Council and officials of Junta da Freguesia de Santa Maria Maior who will be interviewed are involved in pedestrian or traffic calming projects. In particular, the interview is to be conducted with Pedro Homem de Gouveia, coordinator of Pedestrian Accessibility plan, and with engineer Carlos Rua. In regards to local authorities, the interview will be conducted with architect José de Melo Carvalheira, from Junta da Freguesia de Santa Maria Maior.

Before detailed analysis of pedestrian priority zones, it is necessary to provide a number of definitions related to the topic.

Traffic calming, according to the Institute of Traffic Engineers, is “the combination of mainly physical measures to reduce the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users”.

Pedestrian is usually defined as any person who is walking in public area. Since it is typical for everybody, being pedestrian more a temporary state than category.

Pedestrianisation may be defined as a conversion of a street for pedestrian use only, however, vehicles are permitted in exceptional cases (emergencies, etc.)

Residential areas are “unbroken areas with a living, shopping, or work function”.

Speed management can be defined as “a set of measures to limit the negative effects of excessive and inappropriate speeds in the transport system”.

Zone 30 - section of a street (or streets) which accommodates all types of road users. There speed limit of 30 km/h is imposed, cyclists can go in both directions (if the opposite is not stipulated by local authorities) and a number of transformations is effectuated to make a zone more adequate for the speed limit applied (this refers, in particular, to the installation of signs at the entrance/exit to the zone)¹.

¹Ministère de l'Intérieur (2014). Code de la Route

Zone 20 is a street(s) section also hosting multiple types of road users where pedestrians have priority and can circulate on the road for motorized vehicles though without stopping there. Speed limit of 20 km/h is applied. Cyclists can go in both directions (if the opposite is not stipulated by local authorities) and a number of transformations is effectuated to make a zone more adequate for the speed limit applied.

CHAPTER 1. EVOLUTION OF PEDESTRIAN PRIORITY ZONES

1.1. European and American tradition of pedestrian priority zones

Before the invention of a car and its appearance on the roads, street organization suggested the use of space by all actors on equal basis: pedestrians were sharing the street with carriages and cyclists. However, cars greatly changed the existing street pattern as they became faster and more available for the population. The need to make circulation safe and well-ordered in the face of motorization resulted in the segregation of various street actors: a large part of street space was given to the automobile, with cyclists and pedestrians being moved aside. The car caused a number of negative consequences in the cities, for example, crossing the street became more complicated and dangerous, land use became more dispersed and, in addition to that, street furniture aimed to separate motorized traffic from other street users (like sidewalk curbs) made walking less comfortable.

The emergence of first pedestrian malls in Europe dates back to 1926, when first pedestrian street in Western Europe was opened in Essen, Germany. However, after the Second World War, and especially in the sixties, pedestrianization plans became more widespread and common practice: “In the forties and fifties, the idea of traffic-free town center shopping streets was conceived but it was not until the sixties that pedestrian

areas came into their own”². There are several reasons for that. Initially closing of a street was not part of particular planning idea, but was mostly an answer to increasing levels of congestion on narrow streets in historical centers where motor traffic on full scale was not possible in any case due to the width of a street. Yet destructive consequences of war partially changed this approach: certain professionals, especially in the United Kingdom, regarded post-war conditions in Europe as a unique opportunity to rebuilt and modernize city centers in a revolutionary way after they were devastated by the conflict. For example, this idea was expressed by the architect Donald Gibson, responsible for the post-war reconstruction of Coventry, a city in the United Kingdom largely destroyed by the bombings. Gibson described those conditions as “the opportunity, which may never recur, to build a city designed for the future health, amenity and convenience of its citizens”³. The plan elaborated by Gibson suggested grouping of newly built buildings according to the functions which they had to perform (leisure, business, commercial), thus forming several areas for different purposes. Retail trade was concentrated in the special pedestrian shopping precinct, which was closed to traffic. Besides, shopping facilities were organized in two levels: there were shops on the ground floor which had shelters, and these shelters formed the upper level shopping area. The arcades permitted shopping in rainy days, and access to the elevated part of the precinct. Clearly shops located at the ground level were more attractive for customers, but at the same time less expensive rental prices of the upper level facilitated the installation of small retail trade there, while big brands occupied the lower level. After the idea of making a walkway above the ground level and above the street was implemented in many American cities. This model, which suggests strict segregation of traffic from pedestrian flows is indeed capable of reducing significantly the number of pedestrian injuries. However, when elevated walkways were introduced in London, they did not turn out to be successful and soon became mostly abandoned because they were fragmented so did not form proper network, some people found it hard to use due to poor navigation and some did not want to go up the stairs. As

² Uhlig, K. (1979) *Pedestrian Areas; From Malls to Complete Networks*, p.6

³ Gould J., Gould C. (2009) *Coventry planned. The architecture of the plan for Coventry 1940-1978*, p. 17

it was noted years ago by English classic Charles Dickens, “most people would prefer to face the danger of the street rather than the fatigue of getting upstairs”⁴. Still, in Coventry where elevated parts do not have big extension, they still managed to attract users, however, ground level of the precinct remains much more vibrant. Coventry’s scheme is a rather radical example of post-war reconstruction, nevertheless, it shows the impact that the conflict had on cities’ structure in Europe, and evidences relatively common reconstruction practice also applied in Kassel, Germany, and Plymouth, the UK.

First generation of pedestrian malls in the USA dates back to 1959, when first pedestrian-only street was opened in Kalamazoo, Michigan. The project was elaborated by the architect Victor Gruen, who regarded city structure as “a small-grained pattern in which certain functions may be grouped, and where vital and intimate relationships between all these groupings exist”⁵. Since cars and motor traffic demand much space, they may be a threat for the preservation of compact urban system, and especially city centers.

Pedestrian-only street in Kalamazoo was opened when the city center attractiveness was compromised by the emergence of large suburban shopping malls, so pedestrianization was regarded as a way to revitalize the downtown. In the following years many cities adopted this approach and by the end of the seventies around 200 pedestrian streets were opened in the country.

However, in the 1980ies many American pedestrian streets started to loose popularity and were reopened to traffic. Some authors (Jane Jacob for example) explain the failure of pedestrian mall in the USA by poor public transportation. Without proper transport service the use and accessibility of the site depended greatly on the amount of parking lots being offered near the pedestrian street, and this amount was often insufficient, what resulted in poor performance of pedestrianized streets. On the contrary, when pedestrian street had been complemented by additional activities, its popularity

⁴ Vanderbilt, T. (2008) Traffic. Why we drive the way we do?

⁵ Brinkerhoff Rosen, S. (2006) The success and failure of pedestrian malls in Europe and America, p. 6

grew. Santa Monica's Third Street promenade may serve as an example: opened in the 1960ies, it was an ordinary pedestrian-only shopping street in the city center, so as commercial centers were built around it, the street was slowly losing liveliness and attractiveness. In an attempt to confront this trend local authorities introduced more parking facilities near the area, however, it did not help to retain the decline, which became even more evident in 1974 when a large shopping mall was opened in the end of the street. At this point, the authorities started to look for innovative means of reviving pedestrianized street, and to achieve this aim, it was decided to favor recreational use of the street. New design elements were applied, but even more important was the decision to place theatres and cinemas at Third Street promenade and prohibiting their construction in other city areas. As a result, the street managed to attract lots of people and remain vibrant. Still, the majority of pedestrian malls in the USA were not that successful.

Another factor that affected pedestrian-only streets in the US is their width and length. In other words, they were too large for the facilities which were offered (mostly, shops) and were not designed for recreational or other use. When cars were prohibited, these streets began to look empty. Street furniture in the majority of cases was standard (benches, trees), so apart from shopping, people had nothing to do there, and the sites seemed to be boring. Besides, when malls were perceived as being too long, shop owners were reluctant in establishing their business in the middle of a street, fearing that customers would not want to walk so far.

In addition to that, centers of American cities started to steadily lose population in the 1970ies. During this period, downtown areas saw an average decline by 10%⁶ in the number of inhabitants. Sometimes pedestrian malls were installed too late in areas where low levels of population could no longer sustain it. As car was becoming more and more available for population, distance was no longer a serious concern and many people could afford comfort living away from the city center. In order to reply to the demand in newly built zones, large shopping malls were opened in suburban areas, thus inhabitants

⁶ Brinkerhoff Rosen, S. (2006) The success and failure of pedestrian malls in Europe and America, p. 15

of such neighborhoods were no longer obliged to shop in the center. Naturally, they preferred to shop in the shopping mall nearby and this strongly affected retail activities in downtown areas, which were predominantly used by office workers and low-income population groups. Thus during working hours city center remained vibrant, but became empty and in some cases even dangerous in other periods. Urban sprawl and income growth “has been used to create an ugly and wasteful pseudo-city, too spread out to be efficient, too superficial to create a true culture⁷”.

In Europe spread of suburban shopping malls in 1970ies also affected many city centers and pedestrian streets were regarded as a way to diminish this negative impact. At first, shop owners were opposing the ideas of pedestrianization, however, soon after a street is converted into pedestrian-only, an increase in sales is registered. For example, Bonn, Cologne and Hamburg witnessed a 50% rise in the number of visitors on pedestrianized streets, what boosted the commerce. Shop owners who feared that once car access would be restricted, nobody would visit their shop, observed that, on the contrary, pedestrians were much more willing to buy something as they were walking in the area and looking at the goods exposed. For example, after closing several streets for traffic in Munich, Nuremberg, Darmstadt and Bamberg, an average increase of 49.1% in the number of visitors of these streets was registered (Ped malls west Germany). Since closure to traffic was viewed as a way to promote shopping in the center, normally the street which already had high level of commercial activity was pedestrianized. At the same time, the inability of a street to accept full flow of traffic was also additional reason to pedestrianize it. Due to significant commercial success of pedestrian malls in Europe, property rents in these areas increased and this changed the commercial structure on the streets: small shops were replaced by retail chain stores, department stores and luxury shops. Often property rents on pedestrian streets are 50% higher than in other places, so only major retailers can afford installation there. It should also be noted that certain type of shops may suffer from pedestrianization: it refers particularly to furniture, carpet and

⁷ Oc, T., Tiesdell, S. (1997) Safer city centers: reviving the public realm, p. 15

hardware stores, because often proper delivery of heavy goods may be complicated on pedestrianized street.

In 1988 the European Parliament adopted the European Charter of Pedestrians' Rights, highlighting the importance of limiting car dominance in urban landscape and the necessity to adjust cities to the needs of humans and not vehicles. The Charter acknowledged the right of people to live in friendly environment which would also serve vulnerable parts of population like children, elderly people and disabled. Comfort environment suggests the elimination of physical obstacles on the streets. It was recognized that basic amenities should be within walking or cycling distance. Regarding pedestrianized areas, the Charter stresses that these should be in harmony with the surrounding areas.

In the 1990ies pedestrianization plans were associated to the idea of urban renewal and tourism promotion. Pedestrian streets were viewed as a perfect environment for tourists as they permitted to enjoy architectural and monumental heritage while walking. Without the need to look around for moving vehicles, tourists feel more relaxed and are more likely to stay on the street, go for a coffee or to shop. Nowadays pedestrianization is perceived as means to recover historical character and identity of a city, to revitalize public space and favor walking.

Recently even in the USA, where many pedestrian malls failed and thus the general idea is regarded with suspicion, a number of cities has come up with initiatives of pedestrianizing certain places. The most remarkable present-day example is the pedestrianization of Times Square and Herald Square in New York, which started in 2009 as an experiment made to allow the officials to see how people react on new pedestrian areas and what the consequences for city's traffic are. During this trial period, the site became decorated with artistic drawings on the pavement and chairs and tables were placed. Before the implementation of the project, data concerning travel times, pedestrian and traffic flows, traffic accidents was collected, then similar research was conducted after the experiment to evaluate the effects. As it was found out, the revenues

for local business increased by 71%⁸, pedestrian volume on Times Square increased by 11% and on Herald Square by 6%, injuries for motorists and passengers decreased by 63% while pedestrian injuries went down by 35%. Overall, 74% of New York residents claimed that Times Square was largely improved and about two-thirds of local retailers wanted the square to remain in its new form⁹. Taking this feedback into consideration, the authorities decided to make the site permanently pedestrian-only. Nowadays, Times Square and Herald Square hold numerous artistic performances and attract locals and tourists.

At the moment, there are several different types of organizing pedestrian streets. A model when single street is pedestrian-only is the most common, used both in cities with grid street pattern and in cities with less formal street structure. The case when several streets are made fully pedestrian is called a pedestrian zone and corresponds to the labyrinth model. This model may be successfully applied in historical centers with medieval chaotic street pattern. Another model suggests a crossing between one main pedestrianized street and one or several other streets which are parallel to each other. This solution best fits in grid street structure. The last type is disconnected pedestrian street, which includes several pedestrianized sectors, separated by sections where traffic is allowed. This model eases delivery problem for local retailers and guarantees better accessibility of the site.

As pedestrian malls were becoming more common in the city centers, planners started to think about the applicability of pedestrian priority zones in residential areas. However, pedestrian-only street has to be functional in order to retain visitors and avoid abandonment, whereas streets in residential areas are mainly used for dislocation and are not commercialized enough to be fully pedestrian. Strict traffic limitations would make streets in these areas desolated, so alternative solutions had to be found. In the 1970ies most residential areas had poor image of pretty dull places where parking lots and roads occupied much space even though there were not so many moving cars on the streets. However, since streets were often empty, drivers tended to overcome the speed limit,

⁸ Luís Gabriel Cruz, J. (2014) Snohetta Makes Times Square Permanently Pedestrian

⁹ <http://www.nyc.gov/html/dot/html/pedestrians/broadway.shtml>

making neighborhoods dangerous. The use of these areas was quite limited as people were working and having good time in other districts, and were coming back to residential areas just to sleep. The existing environment and street design did not favor any alternative use of such places. In an attempt to make residential areas more lively and pleasant, Niek de Boer, Professor of Urban Planning at Delft University of Technology, developed new street design. In the core his project was meant to make streets safer for children to play by creating an environment where drivers would not feel like the street belonged to them, but would rather feel that other street users have priority and so would be attentive to them. This new street organization would later be called “woonerf” (residential yard). Aiming to provide better walking facilities and to promote different uses of residential areas, local authorities in Delft decided to test the woonerf concept in 1969 in some low-income neighborhoods of the town which lacked playgrounds. With support and participation of local residents, the concept was implemented, resulting in a space where the absence of curbs created an integral space. Speed is controlled by altering the road layout, adding chicanes, curb extensions, speed humps. Later greenery and street furniture was added to the streets. Thus woonerf is organized mainly to promote livable space where pedestrians and cyclists have priority, but cars are still permitted. In the 1980ies a new radical approach was applied to these areas with the de-installation of explicit traffic signage. The idea belonged to Hans Monderman, traffic engineer who was studying road safety at intersections. In contrast to traditional way of making intersections safer by putting more signs, he suggested to remove them. Soon it was noticed that on the intersections which lacked traffic signs, drivers were slowing down and were driving with more caution. A 40% decrease in speed was registered (in contrast to 10% decrease resulting from traditional traffic calming)¹⁰. Woonerf experiment in the Netherlands has proved to be successful (nowadays there are about 6000 woonerfs in the country¹¹) so this model was adopted by some other countries. One of the most interesting examples of shared space in the “urban lounge” in St. Gallen, Switzerland. Before the project, the site,

¹⁰ Hamilton-Baillie (2008) Shared Space: Reconciling People, Places and Traffic, p. 168

¹¹ Hockenos, P. (2013) Where “Share the Road” is Taken Literally

located in the city center, was a mixture of old buildings and newly built offices, so it hardly had any identity and people, not being interested in the place, would just pass the area without stopping. A public-private partnership between local authorities and the bank which occupied new office buildings wanted to revive the place. Soon a square covered with red rubber appeared in the city. Benches, decorations and facilities for children favor people to relax and spend time there. Cars and cyclists were not prohibited from entering the area, however, they have to move slowly since space for vehicles was narrowed. In Denmark the modification of street organization resulted in the emergence of silent roads, which normally have the speed limit of 30-40 km/h, but no street user has priority, however, zebra crossings are protected by speed humps and sidewalks are widened. Some researches indicate that these measures can be implemented on the streets where traffic volume in rush hour does not exceed 200 vehicles per hour and on neighboring streets the volume is less than 400 vehicles per hour.

For example, in the United Kingdom these type of street organization, called home zone, started to be implemented in the 1990ies. In the USA the term “complete street” is used to designate same organizational model, however, it has not yet gained widespread application in the country.

1.2. Evolution of the concept of pedestrian priority zone

The evolution of pedestrian priority zones was driven by ideas that dominated in the sphere of planning in different periods.

Initial post-war projects which envisaged city reconstruction in a revolutionary way were influenced by modernist ideas, for example, by the Charter of Athens (1933), so often suggested separation of pedestrians from road traffic, facilitate dislocations by car and divide city's areas according to their functional role, for example, commercial and leisure districts in Coventry. In the years following the war it was believed that active trade

in a city center should be facilitated by providing easy access to central areas of retail trade by all forms of transport, including private vehicle.

When Gibson started to develop the reconstruction plan for Coventry (approximately in 1941), he was influenced by the works of Le Corbusier and his ideas, which pointed out the necessity to de-congest city centers, increase their density, provide various means of transport and create more open spaces and parks. However, even though Le Corbusier regarded the construction of tall buildings as a way to increase density and gain place for open spaces, Gibson decided that in the case of Coventry tall buildings did not harmonize with a small ancient town.

In 1943 "Architectural Forum Magazine" initiated a project "194X", called like that to show the hope that the war would soon be over, and planners would have to think about designing post-war city. Following the American planners, their colleagues in Europe discussed post-war reconstruction of Western European cities during VIII CIAM (Congrès International d'Architecture Moderne) held in 1951. It was noted that cities at that time no longer favored human contact, city centers were deteriorated and devastated after bombings. The city centers, cities' "core", had to be modified. There were distinguished several factors that would impulse urban renaissance: giving priority to pedestrians and not cars, creating pleasant architectural environment and finally introduce entertainment sites which would favor human contact and interaction (like cafés, cinemas, etc.) A city should be divided according to the functions of certain districts (residential, business, etc), with each of these districts having its own core, and then the main core of a city in general is the traditional city center. Circulation of vehicles inside these "cores" of a city should be prohibited as these places are destined to pedestrians and possess community facilities like libraries, theatres, etc. Traffic was to be separated from pedestrian flows

Following the CIAM, the idea that motor traffic in central areas could foster their prosperity was further disputed in the 1960ies. At that period city centers already had problems with congestion on the streets. Simultaneously, large commercial centers started to appear on the outskirts and in contrast to central areas, they provided easy

access by car and excellent parking facilities, things that central retail trade could not offer. Thus pedestrianization was viewed as, primarily, a way to reduce levels of congestion, but also as a possibility to support shopping in the center. City core was not able to manage the same amount of traffic as suburban shopping mall could handle, nevertheless, center could offer outdoor shopping in pleasant environment on the condition that circulation of vehicles would be reduced.

Concerned about the growth of car-ownership rates and frequent incapacity of urban road systems to sustain it, the British Ministry of Transport commissioned a research about the problem and assigned Sir Colin Buchanan, engineer and architect, as the head of the research group. The final report "Traffic in Towns" (1963), which had great significance for the specialists in the area, highlighted the problems caused by high rates of motorization and their negative impacts on the cities which were to come in the future: "The briefest acquaintance with the conditions that now prevail in towns makes it clear that traffic congestion has already placed in jeopardy the well-being of many of the inhabitants and the efficiency of many of the activities. Unless something is done about the potential increase in the number of vehicles that come together in neighborhoods the conditions are bound to become extremely serious within a comparatively short period of years. Either the utility of vehicles in towns will decline rapidly, or the pleasantness and safety of the surroundings will deteriorate catastrophically - in all probability both will happen together."¹² As means to confront this trend, Buchanan suggested delimitation of certain urban zones ("environmental areas" or "urban rooms") which would have different spatial organization with the aim to improve the level of comfort for street users, evoke social activity and to reduce air and noise pollution. The evaluation of these zones would be based not only on their capacity to accommodate traffic, but also on the environmental indicators of the area. Vehicles would be permitted to use these areas, however, the volume of traffic would be limited according to the functions which different zones perform. Besides, as "urban rooms" aimed to promote walking, street design should have been modified to give priority to pedestrians and speed limits were to be introduced.

¹² Federal Highway Administration (1994) National Bicycling and Walking Study, p. 11

This model later inspired the woonerf concept. Separation of various land uses from each other and attribution of specific purpose to each zone were dominant

Victor Gruen, the creator of first pedestrian malls in the USA, believed that central areas, even being attractive due to the concentration of activities and functions they perform, might become abandoned if they lacked accessibility and pleasant environment. Still, Jacobs (1961) states that pedestrian projects developed by Gruen did not manage to become interesting sites for people to spend time there and were mostly designed as a shopping place, what eventually led to their closure.

As it has already been highlighted, commerce on pedestrian streets slowly became dominated by large chain stores, department stores and luxury boutiques and as a consequence the area turned out to be less comfortable for living. In Germany in an attempt to confront this trend and to maintain city centers vibrant, local authorities were recommending pedestrianization only when it promoted mixed-use of the area and organization of different activities. Environmental and community concerns appeared in the 1970ies with the second generation of pedestrian streets.

Pedestrianization projects, apart from being important part of traffic calming measures, often aimed to achieve certain additional results, connected with the quality of urban public space. Jan Gehl distinguishes three levels of human activity in public spaces:

1. necessary or compulsory activities, such as walking to work, shopping, or waiting for a bus;
2. optional activities (i.e., strolling, sitting, sunbathing) chosen only if the conditions and the place are inviting;
3. social activities, such as talking, people watching, and community events, which depend on the presence of other people”¹³.

In France in the 1970ies pedestrian street installation was connected with promoting tourism and creating an image of a city, and for sure pedestrianized streets

¹³ Gehl, J. (2010) Cities for People, p. 5

created friendly environment for walking trips and attracted many tourists. However, as a negative side of this process, thieves and beggars also appeared on these streets, partially because of tourists.

In the same period, the concept of *woonerf*, or shared space, was developed. Even though it first appeared in the Netherlands, it was partially inspired by Colin Buchanan's "Traffic in towns". Overall, this report suggested the delimitation of public realm where traffic would be limited so basically the idea of segregation of pedestrian flows from traffic was modified: earlier it was advised to separate them in urban space, while Buchanan proposed certain integration of these actors in urban environment with the priority given to pedestrians.

A bit later Hans Monderman developed the idea of integration. Trying to find means of increasing safety on conventional intersections, Monderman doubted whether installation of more elaborated traffic signs could significantly change the situation. Instead, he came up with an innovative approach of removing traffic signage in certain areas: "When faced with a safety problem, most engineers tend to install something additional. My instinct is always to take something away"¹⁴. Basing himself on behavioral psychology, Monderman assumed that people once left without distinctive traffic signs would be more uncertain while driving and would slow down the speed. He believed that in a place with traditional traffic signs people tend not to think about the actual situation on the road and other street actors, they do not try to adapt themselves to the existing conditions, relying completely on signs and acting accordingly. In addition to that, lack of social interaction and human contact on the road was making public realm unpleasant and sometimes dangerous. On the contrary, when signs are removed, people are more cautious: "It works well because it is dangerous, which is exactly what we want. But it shifts the emphasis away from the Government taking the risk, to the driver being responsible for his or her own risk."¹⁵ During first experiments on the intersections signs, signals, curbs, barriers and road markings were removed, and since the results of these

¹⁴ Hamilton-Baillie, B. (2005) *Streets Ahead*, p. 1

¹⁵ Millward, D. (2006) *Is This The End of The Road for Traffic Lights?*

initiatives were positive, Monderman could switch to small towns and villages. In the built environment, all hard safety measures (including pedestrian crossings, traffic lights, warning signs, speed humps) were de-installed and substituted by new road layout which did not show clear distinction between road and sidewalks, between pedestrian and motor vehicle facilities. As it was later discovered, these measures actually managed to reduce average speed, make the sites more appealing and safe, even though small collisions remained. Concerning it, Monderman reacted: “We want small accidents, in order to prevent serious ones in which people get hurt”¹⁶.

To sum up, in the beginning traffic calming measures were introduced to put physical barriers on the roads, thus changing the way the car is driven, but not influencing the driver’s behavior. Later, however, it was noticed that when driving at lower speed drivers are more likely to give a way to pedestrian even in places without pedestrian crossings.

In the 1980ies pedestrians and their interests became more pronounced. Local authorities started to plan for pedestrians and to take into consideration their wishes, but before pedestrians were often neglected because automobile groups were way more influential and noticeable, whereas walking, as it was believed, did not demand much infrastructure improvements and at the same time it was not considered as a transport mode on its own, but more as a temporary state of an individual after he/she had finished using public transport or private vehicle. In fact, walking is the most frequently used dislocation mode for distances between 1,5 and 2 km¹⁷. Moreover, in the 1970ies and 1980ies cars and parking lots occupied 80% of inner city areas, whereas 80-90% of trips within the central area were made by walking, thus installation of pedestrian malls was a natural reply to balance this disequilibrium.

Residents from the streets that were neighboring a pedestrian street usually feared that closure of a street nearby to traffic will provoke significant increase in traffic in the

¹⁶ Millward, D. (2006) Is This The End of The Road for Traffic Lights?

¹⁷ Manuel Floro Semião, V. (2008) A Impotência dos Espaços Públicos Pedonais na Revitalização dos Centros Históricos, a Baixa de Lisboa

adjacent areas. However, in the majority of cases the rise in traffic was not as serious as expected, for example, in Copenhagen after pedestrianization of Stroget 72% of vehicles which had been previously on this street re-appeared on neighboring streets, whereas in Norwich pedestrianization of London Street resulted in only 40% of vehicles relocated in vicinity districts. At the same time, since pedestrian streets were introduced in city centers, they normally did not affect large part of residential population.

Pedestrian priority zones are frequently regarded as traffic calming measures. According to Almeida (Almeida,2004), these measures may be divided into two types: segregation (aimed to control traffic volume) and integration (aimed to control the speed). Thus in the first case, certain transport modes are isolated or excluded from particular area, in the second case different means of transport coexist, but safeness and environmental aspects are respected. Despite the fact that traffic calming measures are introduced to ameliorate local environment and solve particular traffic problems, they may have some negative consequences, for example, installation of pedestrian priority zones may harden the passing of emergency services, may increase the amounts of traffic on neighboring streets and the time local residents spend on their journeys, may be difficult for orientation of people with poor vision.

CHAPTER 2. TYPOLOGY OF PEDESTRIAN PRIORITY ZONES

2.1. Prerequisites for installation of pedestrian priority zones

One of the most relevant questions in installation of pedestrian priority zones is to select and define a site where these measures would suit the best. Generally it is believed that pedestrian priority zone installation is suitable on city's complementary streets and is not recommended for major axis whose main aim is to accommodate biggest traffic flows. Simultaneously, according to CERTU¹⁸, these major axis normally do not occupy more than 20% of the total road network in urban centers, what makes about 80% of urban streets potentially suitable for transformation into a pedestrian priority zone. It is hard to predict whether new zone would be a success or failure, however, in certain conditions their introduction is likely to ameliorate the area. Three major components should be taken into consideration: the safeness of an area, its functional complexity and its operability¹⁹. In these areas the demands for parking lots and better traffic capacity may result in conflicts between various road users, like cyclists, pedestrians or drivers. In other words, existing local urban organization is not compatible with speeds that are used or levels of traffic.

Definitions of zone 30 or zone 20 may slightly vary according to national legislation, but are generally very similar. Recommendations elaborated by OFROU (Office Fédéral des Routes, Switzerland) suggest dividing existing urban routes in two categories: streets with traffic orientation and streets of local interest. First group guarantees efficient connections and transit and ensures economic vitality of a city. This group is mainly constituted by main urban axis. The other group comprises secondary routes which are generally suitable for implementation of traffic calming measures. There, the composition

¹⁸ CERTU (2009) Aire piétonne, zone de rencontre, zone 30: quels domaines d'emploi? p.2

¹⁹ César Bastos Silva, A. M. et al. (2004) Potencialidades das técnicas de acalmia de tráfego na regulação do atravessamento das localidades, p. 3

of street users is very varied and naturally, conflicts are more likely to happen when they encounter each other, so management of streets in these areas should consider the interests of different groups of users.

Usually it is important to reduce traffic pressure in historical city centers, where compact spatial organization results in limited public space, so these areas are not suitable for motorized traffic. For example, a plan for cycle facilities which has been recently elaborated for Seixal (Portugal) states that zones 20 (named mixed use streets in the plan) are to be implemented in historical centers where the distance between buildings equals 8 meters or less²⁰. Sometimes even major traffic axis can partially become zones 30 if they pass through historic center.

Speed reduction is applied in residential districts where excessive use of private vehicle may result in accidents involving vulnerable parts of population, like aged people or kids, and in diminution of public space. “Residential areas are unbroken areas with a living, shopping, or work function”²¹, so these districts were not created for through traffic, but mostly for dislocations inside the area, thus through traffic should be discouraged in residential areas. Implementation of zones 30 in such areas is highly recommended by the European Parliament²².

Additionally, measures of traffic limitation may also be applied in central business districts. These areas often suffer from high congestion levels due to abundant use of private vehicle, however, public transport is usually well-developed in such districts, so often the use of a car is not essential for accessibility.

Both zones 20 and 30 fit better in the areas which constitute unified space, being distinctive from surrounding districts. Generally serving well for residential areas, zones 20 may not work in some of them if urban landscape does not favor outside activities. For example, an attempt to introduce woonerf in Boulder (USA) was not quite successful

²⁰ Arede, H. et al. (ca. 2010) Plano da Rede Ciclável do Concelho do Seixal, p. 32

²¹ SWOV (2010) Zones 30: Urban Residential Areas, p. 1

²² European Parliament (2011) Resolution on European Road Safety 2011-2020, art. 54

because houses on the street affected by the project already had backyards which served as playground for kids and recreational site for adults, so after the implementation of zone 20 people did not change their habits, preferring their backyards to newly reconstructed street. Regarding zones 20, they work better when there is lack or absence of open spaces in neighboring areas, and zones 20 can attract not only local inhabitants, but residents from other districts as well. Taking this into consideration, it is important to consider the implementation of zone 20 not in isolation but as a part of a greater plan affecting numerous urban districts (for example, plan for amelioration of cycling or pedestrian facilities or traffic calming initiative).

Areas which are subject to installation of 20 km/h speed limits are actively used by pedestrians who often tend to cross a street in a place where he/she chooses, so safety concern is primordial. In Paris, for example, newly introduced zones 20 were implemented on the streets where people frequently walked on the road instead of sidewalks, so in this case speed reduction was more like a formal response to the interests of pedestrians. Commenting on this situation, Julien Bargeton, transport advisor in the government of Paris, told: “We were just pragmatic”²³. High levels of pedestrian flows and elevated number of cyclists are often mentioned as a favorable condition to pedestrian priority zone installation²⁴. For this reason, another common site for the introduction of such zone is the place where many people change transport modes, like central squares or square/streets near railway stations. In some cases, zone 20 may be a solution for narrow streets which cannot accommodate sidewalks wide enough to be used by people with reduced mobility. In this scenario, zone 20 giving priority to pedestrians urges the drivers to respect them, but at the same time encourages compact land-use. In addition to that, areas considered dangerous due to road traffic by local residents who prefer to stay at home for that reason may also be potential zones 20, offering better environment to inhabitants.

²³ Kleiber, M. (2013) A Paris, la Priorité aux piétons gagne du terrain

²⁴ Sisman Ebru, E. (2013) Pedestrian Zones, p. 405

It is logical that zones 20 and 30 are generally introduced in problematic neighborhoods, as accident rate is important criteria frequently considered before the installation, and these numbers are generally higher in deprived areas. For example, in London representatives of “black” ethnic groups are 1.3 times more likely to suffer from collisions than members of “white” groups²⁵. In the United Kingdom, the choice of the area of implementation depends on the number of traffic collisions per km of the road and accidents involving kids or vulnerable users²⁶. It is claimed that 30 km/h speed limit may be effective on roads where casualty rate is higher than 0,7 casualties per kilometer²⁷. However, since zones 30 are often welcomed by the residents, sometimes local authorities insist on their implementation in areas which do not have high accidents rate. Thus, the Institute of Public Policy Research revealed that 77% of local authorities took into consideration casualties’ rate while pondering on the introduction of zones 30 but local demand and proximity to schools were also important factors.

The introduction of a speed limit narrows the difference in speed between various road users and decreases the chance of serious accidents which cause death or bad injuries, since the consequences of an accident depend on the vehicle’s speed at the moment of collision, and these consequences are less serious when speed is 30 km/h or less. In Helsinki (Finland) 54 pedestrians died in road accidents in 1967 whereas in 2009 this figure decreased to 3 persons even though car ownership rates in the city went higher. Naturally, such decrease was conditioned by numerous factors, but implementation of zones 30 definitely played a significant role. The evolution of zones 30 in Helsinki may be tracked on the following picture:

²⁵ Grundy C. (2008) The Effect of 20 mph Zones on Inequalities in Road Casualties in London

²⁶ http://www.doncaster.gov.uk/sections/transportstreetsandparking/roadsafety/Traffic_Calming_and_20_mph_Zones.aspx

²⁷ Grundy C. (2008) The Effect of 20 mph Zones on Inequalities in Road Casualties in London

DYNAMICS OF SPEED LIMITS IN HELSINKI

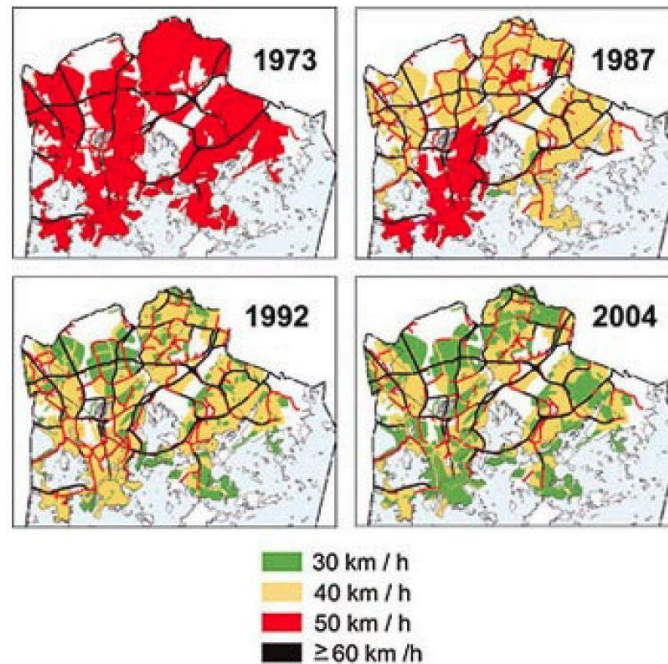


Image source: Madrugá, P. (2010)

In the case of an accident, a pedestrian who is hit by a car moving at the speed of 60 km/h has 10% probability of staying alive, when the car is driven at 45 km/h this chance is increasing to 45% and when a vehicle is moving at 30 km/h the pedestrian is likely to survive (90% probability)²⁸.

In addition to what was already mentioned, speed limit allows to reduce a braking distance, to give a better angle of view to the driver, thus enabling him or her to notice other street actors, and also to establish more balanced share of space among different street users, improving the conditions for dislocation in the area. This is complemented by less noise, no congestion and little smell from the vehicles. Friendly pedestrian environment suggests multiple facilities which animate a street, like cafes and terraces, thus making a street safer. Due to limited vehicle traffic the atmosphere in the area is more relaxed, enabling people to be less stressed without the need to constantly look around for cars. This refers in particular to parents with kids, which in the absence of

²⁸ Dias, V. (2010) Zonas 30

traffic flows do not need to be highly attentive while looking after the kids. Living streets are frequently designed as a social space which favors gathering of people.

Before the implementation of zones 30/20 It is advisable to make an expertise which would concern the hierarchy of urban routes in the area (since these zones are more suitable for secondary roads), existing safety problems on the roads and types of frequent accidents, speeds used in the area, parking needs and quality of street environment in general. When applied to a large district it is advisable to split the territory into multiple areas in order to adjust the project to the needs of residents and their view on the neighborhood. In the case of zones 20, it is crucial to involve residents in the process of elaboration of a project and to do that local community has to be delimited. UK Department for Transport recommends to regard as a community:

- local residents (fundamental part in decision-making process);
- residents of the areas nearby (should be informed about what is being done and why);
- community organization (can help in involving local residents in project discussion);
- frequent users of the area (visitors, workers, who should be informed about the project but not necessarily involved in the discussion).²⁹

All population groups should be involved, and especially those that often stay away from the decision-making process, like kids, teenagers, disabled people or ethnic minorities. 3D visualizations of future zone in Newcastle-under-Lyme helped to involve in the discussion people with poor vision and those who suffer from language barrier. Besides, zone 20 implementation may impulse the creation of a community: residents get to know each other during the discussion and later encounter each other while using the zone.

Also it is essential to consider the needs of emergency services and their proposals for the project. For example, in Dover (United Kingdom) residents wanted more parking

²⁹ Department for transport (2005) Homezones: Challenging the Future of Our Streets, p. 39

space, however, it was incompatible with the demands of local fire service, which insisted on maintaining the width of a carriageway, so eventually the project was not implemented.³⁰ Larger zones cause longer delays in emergency services: it was calculated that an emergency vehicle would need about 31 seconds more in zone 30 of 2 km²³¹.

In many cases zones 20 are based on the local characteristics and activities already existent in an area, thus complementing and developing them. For example, areas close to schools are often characterized by significant levels of pedestrians and cyclists, as well as children playing, so if zone 20 is implemented near school (which is quite common), parents are more likely to let their children walk or cycle to school.

Theoretically zones 30 can be implemented on any street unless it is a vital axis of urban circulation. In Barcelona, for example, zones 30 occupy 43,5% of the total road space (the rest is attributed to vehicles)³², while in the United Kingdom about three million people live in zones 30³³. However, if the area of intervention is characterized by vitality and intense local life (for example in residential areas, near schools, etc.) and the need to reduce traffic on intersections the installation of zone 30 is more likely to produce positive effects, especially if it is implemented in the whole district or part of it, and not only one street. As a rule, recommended dimensions for zone 30 are 2 km² because if the area is larger, surrounding streets may become overloaded with traffic. Distribution of vehicles in residential area depends on its structure, which may be represented in three basic ways: grid, organic and mixed³⁴.

³⁰ Department for transport (2005) Homezones: Challenging the Future of Our Streets, p. 21

³¹ SWOV (2010) Zones 30: Urban Residential Areas, p. 3

³² Madruga, P. et al. (ca. 2010) Analysis of 30 km/h Zones, p. 10

³³ Madruga, P. et al. (ca. 2010) Analysis of 30 km/h Zones, p. 4

³⁴ SWOV (2010) Zones 30: Urban Residential Areas, p. 3

GRID, ORGANIC AND MIXED STRUCTURES IN RESIDENTIAL AREAS

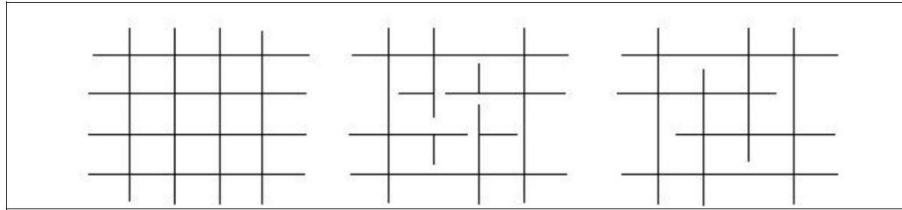


Image source: SWOV (ca. 2010)

The first structure guarantees easy access to the zone and relatively equal dispersion of motorized vehicles, but is pricy. The second option is cheaper as there are less roads so maintenance costs are lower and at the same time this structure is highly unfavorable for through traffic since there are almost no direct routes. Finally the third options is a mix of the grid and organic systems.

Relative easiness in installation of zone 30 was appreciated in Dinant (Belgium), where in one of the areas speed limit appears only in July and August due to numerous cafeterias placing their tables and terraces outside on the street in summer months. It is also important to highlight that speed limit of 30 km/h reduces the difference in speed between cyclists and drivers, so it is possible to mix these users on the road, thus separated cycle lanes may not be needed. Speed limit aims to promote the use of alternative transport modes and to enhance liveliness in the area.

Implementation of zone 30 does not necessarily demand significant changes in local environment: basically sidewalks are left for pedestrian use and a roadway for the vehicles and cyclists. The possibility to implement relatively low-cost traffic calming measures on local level allowed to develop “The neighborhood Slow Zones” community-based project in the USA, which aims to decrease speed limit to 30 km/h and which managed to spread in 13 residential areas of New York in one year³⁵. Despite the fact that zones 30 may not need radical changes in urban layout, some transformations are desirable. A research conducted in the Netherlands shows that in areas where only low-cost measures were implemented only 14% of drivers were actually obeying the speed

³⁵ Madruga, P. et al. (ca. 2010) Analysis of 30 km/h Zones, p. 11

limit of 30 km/h, on the other hand, 85% of vehicles were violating the rules but were still driven at less than 45 km/h. However, in areas where coherent street design is adopted, speed limit is generally respected. Budget restrictions often do not allow to implement sufficient street design measures in the whole area, but it is recommended to install them at least at the intersections. It is important to delimit the zone by differentiating it from the surroundings, what may be done with the installation of signs at the entrances to the zone and changing the interior landscape inside it. Signs at the entrance may be a standard vertical signage indicating the speed limit at the entrance and exit, sometimes complemented by signage elements on the road. In the case of signs on the road, it is interesting to explore Paris' experience. Nowadays there are approximately 100 zones 30 in the city³⁶ and 37%³⁷ of Paris streets have speed limit of 30 km/h, what corresponds to the needs of local population, 60%³⁸ of which do not have private vehicle. Due to the fact that implementation of pedestrian priority zones has gained such a scale in the city, Paris started to experiment with signage on the pavement in order to find the best way to inform people about entering these zones.

Proposed projects included lines imitating pedestrian crossing "for car", in other words, the lines are drawn on the road in a way that they address to the drivers and not pedestrians, and in this case it is the driver who uses zebra crossing.

ZEBRA CROSSING IN LINES

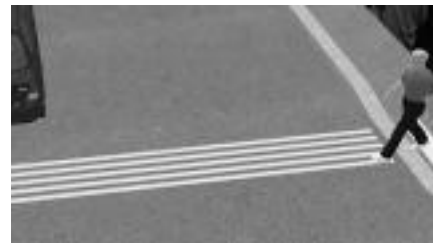


Image source: archeologue.over-blog.com

These solution, which can be easily seen and perceived by drivers as well as handicapped people and guide dogs, is also to be used to mark a pedestrian crossing inside the zone which is not elevated to the level of a sidewalk.

Another solution was the introduction of round symbols which was found hardly visible.

An option with letters was also proposed, being extremely clear for road users.

³⁶ Kleiber, M. A. (2013) A Paris, la priorité aux piétons gagne du terrain

³⁷ Quentin, J. B. (2013) Paris: un tiers des rues limitées à 20 ou 30 km/h dès septembre

³⁸ Quentin, J. B. (2013) Paris: un tiers des rues limitées à 20 ou 30 km/h dès septembre

Moreover, a variant of drawing pixels on the road as an innovative way to delimitate the area was regarded. Aesthetically beautiful, the signage looks like street art, and often drivers start to slow down because they are unsure and curious to know the meaning of the sign. However, this option is expensive and can hardly be understood by handicapped or guide dogs.

In 1992 Graz (Austria) became the first city in Europe to introduce zones 30 on all side roads (about 80% of all roads) and 50 km/h on vital urban axis. Such initiative was partially explained by high numbers of commuters from suburban areas who used vehicles to reach their workplace in Graz city center, which could only accommodate limited number of cars. So the municipality decided to introduce measures that would urge commuters to use less their cars. This drastic change had to be accompanied by information boards explaining traffic regulations in four languages at the entrance to the city. Despite the fact that big information campaign was conducted to show positive

effects from zones 30, the majority of population was strongly against the project. Since it is hard to persuade people that these changes may be beneficial before they are actually introduced, it was decided to set a two-year test period for zones 30. After two years, accident rate went down by 24%³⁹ and the project gained support among the population. Nowadays around 80% of traffic accidents in Graz occur on the roads with 50 km/h speed

ZEBRA CROSSING IN ROUNDS

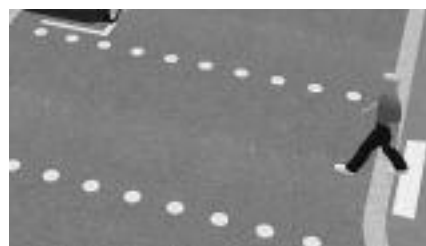


Image source: archeologue.over-blog.com

LETTERS USED FOR ZEBRA CROSSING



Image source: archeologue.over-blog.com

PIXELS ON ZEBRA CROSSING



Image source: archeologue.over-blog.com

³⁹ Stanzer, T. (ca. 2005) Gentle Mobility: The Graz Model of Success, p. 21

limit⁴⁰. One of the most recent and revolutionary examples of zone 30 implementation is the new plan for Paris which pretends to transform large city areas into zones 30. Major urban axes, where speed limit is of 50 km/h, pedestrian streets and zones 20 are excluded from the plan⁴¹

It is believed that more uniform approach to speed limit in a city will cause less misunderstanding among drivers and will facilitate the driving.

2.2. Zones 30, Zones 20 and Shared Space

In cases when mobility is the primary function of a street, segregation of traffic is necessary. Various street users have different speeds, and the bigger is the difference in speed among them, the bigger is the need in separating street actors by delimitating certain areas to be used by specific groups. Delimitation thus should be evident and easy to understand. On the contrary, in cases where street is not essential for mobility and difference in speed between various road users is small, it is possible to promote mixed use of space. In shared space concept, delimitation of areas for different street users should not be applied or at least should be less pronounced. Physical barriers on a street are often causing discomfort and difficulties among those who do not drive, and especially disabled people and children.

Woonerf is opened to traffic, which is, however, regulated by speed limit and additional physical facilities like narrow roads or chicanes that urge the drivers to slow down at the entrance to the zone and continue at low speed inside since the woonerf is not intended to be used by abundant through traffic. Main idea of woonerf is to control the driving speed by street design and not by conventional traffic signage. The entrance and exit to the zone should be marked, inside the level difference between auto space and

⁴⁰ Falk, H. (2008) Citywide 30km/h speed limit – the city of Graz

⁴¹ Britton, E. (2014) An idea of Penang? Paris to limit speeds to 30 km/h over entire city?

sidewalks has to be eliminated, together with traditional elements of road infrastructure like traffic lights, lane dividers, stop signs. According to Monderman, there are two basic types of space: the one for traffic and a social one. The first is designed for vehicles and is used respectively, whereas the second is a place used by many different actors for various purposes. A space for traffic is characterized by “traffic behavior”: people simply need to get to point B from point A, high speeds are common, eye contact is rare and behavior is predictable. Moving around is regulated by traffic signs. This kind of behavior, although more present on highways, may also be adopted by pedestrians in hurry. In social space, similarly, social traffic behavior, which is less predictable than the previous type, is common. Managing social traffic behavior is a hard task as often drivers continue to act in “traffic behavior” mode in areas which are perceived as social by other road users, like pedestrians or cyclists, so conflicts and misunderstanding are likely between them since pedestrians expect social behavior from drivers and while these maintain “traffic behavior” attitude. Often the reason for that are the traffic signs, which do not encourage a shift in drivers’ behavior: for example, a road coming through a small village often seems to be just a part of a highway and drivers continue to look mainly on the road signs. In order to change drivers’ attitude it is important to introduce changes in spatial layout and street design, as simple introduction of standardized signs in such places does not allow to “read” a street and consider it as a social space. Additionally, signs in residential areas aimed to make the drivers slow down do not always work properly: for example, if there are many stop signs around, drivers are likely to violate them⁴², so the effect from these signs is decreasing once their use becomes frequent. Naturally, the idea of withdrawing traffic signs from the streets seems to be dangerous, however, experiments show that people tend to be more careful and attentive when the risk of an accident is higher: “we change our behavior in response to perceived risk”⁴³. Following the traffic signs, drivers feel less responsible for their driving and are less attentive, focusing mainly on the signs and not on the actual situation on the road. In other words, “there is a paradox here: the

⁴² Vanderbilt, T. (2008) Traffic. Why we drive the way we do?

⁴³ Vanderbilt, T. (2008) Traffic. Why we drive the way we do?

system that many of us would feel is more dangerous is actually safer, while the system we think is safer is actually more dangerous”⁴⁴. Besides, sometimes traffic signs produce opposite effects: for example, when a driver wants to pass on the green traffic light in the last moment he speeds up, whereas he should slow down and look around for other street actors. Traffic lights placed high above the carriageway distract the driver from the road as he is looking up for the signal. In addition to that, color blind people encounter difficulties in reading traffic lights and of course it is worth mentioning that on sunny days reading signals from traffic lights is a complicated task for everyone.

The area of woonerf is for residential use and walking and playing are permitted in the whole zone. Seating should also be encouraged on the street with seating areas protected from traffic by physical barriers. It is advisable not to make woonerf longer than 500-600 meters⁴⁵, as longer distance may result in drivers’ irritation from the obligation to drive at the speed of 20 km/h.

Research conducted in the Netherlands in the 1980ies revealed that 70% of the population liked woonerven, 16% were indifferent and 14% disapproved of woonerven⁴⁶.

Studies in the Netherlands show that parents and older population still find vehicles speed inside woonerf too dangerous but admit that the area seems to be safer than it used to be before the introduction of woonerf. Woonerven are more positively regarded by parents, kids and old people than traditional residential neighborhoods, though it is worth noticing that such evaluation mainly originates from changes in the environment: people regard that woonerf facilities make an area more pleasant to play and to live. At the same time, it was observed that people who do not know much about woonerf tend to dislike it, on the contrary, those who know more normally appreciate of the project⁴⁷.

⁴⁴ Vanderbilt, T. (2008) Traffic. Why we drive the way we do?

⁴⁵ Collarte, N. (2012) The Woonerf Concept: Rethinking a Residential Street in Somerville, p. 11

⁴⁶ Kray, J. H. (1986) Woonerfs and Other experiments in the Netherlands, p. 4

⁴⁷ Kray, J. H. (1986) Woonerfs and Other experiments in the Netherlands, p. 6

It is doubtful whether woonerf may be applied to busy intersections or streets, but recent experiments show that it is possible. For example, in 2002 shared space concept was applied to a central shopping street in Haren (the Netherlands) which is used by 8 000 – 12 000 vehicles daily. Positive impact on local business was reported, together with a speed reduction of 5% and improvement in public transport service (more buses coming on time). In another case, shared space was introduced on busy intersection in Drachten (the Netherlands), on a roundabout which was being used by about 22 000 vehicles daily. Traffic signs and signals were removed from the junction, physical barriers that separated cyclists from drivers were remodeled, vertical fountains were added to ameliorate the landscape. As a result, the level of congestion and number of accidents fell down (annual injury rates decreased from 8.3 to 1 in three years⁴⁸), with negotiation and human contact between various road users guaranteeing much safety. It was not evident that foreign drivers/cyclists/pedestrians had problems with using the intersection. Overall impression from the intersection became better so sometimes this newly created place is called “squareabout”⁴⁹. Similarly, shared space was implemented in Lyngby, a suburb in Copenhagen, where around 14 000 vehicles pass through the main shopping street which was redeveloped. This case is interesting because in places where pedestrians are likely to cross the street special diagonal lines were drawn on the pavement to attract drivers’ attention.

EXIT AND ENTRANCE SIGNS TO ZONES 30/20



Image source: CERTU
(2009)

Despite numerous positive effects produced by shared space, woonerven are sometimes criticized for the lack of parking lots, delay of emergency services and residents’ anxiety caused by the mix of transport modes.

⁴⁸ Hamilton-Baillie, B. (2008) Shared Space: Reconciling People, Places and Traffic, p. 171

⁴⁹ Hamilton-Baillie, B. (2008) Shared Space: Reconciling People, Places and Traffic, p. 171

Usually signs for zones 30 simply indicate speed limit, whereas signs for zones 20 are more complicated as more values are assigned to them, and sometimes it is evident from the way they are called in national legislation. In France, for example, zones 20 are defined as “Zones de rencontre”, or meeting zones, so this concept suggests the use of streets not only for dislocation but for some additional activities as well. In the United Kingdom, same type of street organization is called “homezone”, and is defined by the UK Department of Transport as residential streets in which the road space is shared between drivers and other road users with the wider needs of residents (including people who walk and cycle, and children) in mind. The aim is to change the way that streets are used and to improve the quality of life in residential streets by making them places for people, not just for traffic⁵⁰. In this case a sign indicating only the speed limit would constrict the general concept of the zone, as it would seem that speed reduction is the main feature of the area, whereas apart from speed reduction “zones 20” aim to promote mixed use of public space. As a result, signs applied to these zones normally show figures of kids, cyclists and pedestrians (i.e., other street users), along with a speed limit of 20. In many cases, a large figure of a human walking is placed to the front of the sign, thus indicating priority for pedestrians, then comes a figure of a cyclist (smaller) and an image of car, smallest of all. Inside the zone, few signs are used since they may harm the appearance of an area and make it look fragmented. For the same reason, traffic lights and curbs should be avoided. In the majority of cases, potential conflicts between road users are regulated by visual contact, but sometimes, for example in the case of people with poor vision, this may not work, so certain signs are to be maintained. Use of diverse materials to visually differentiate sidewalks from other lines is possible. Signs “30” or “20” put on the ground may be useful to remind the drivers about the speed limit inside a zone. Likewise, infrastructure improvements inside zones 20 are to show that pedestrians have priority: sidewalks should be wide enough and rarely interrupted. In the majority of countries (for example, in Switzerland, France, etc.) national legislation does not give priority to

Figure 1. Zone 20 sign

⁵⁰ Heydecker, B. G., Robertson, S. A. (2009) Evaluation of Pedestrian Priority Zones in the European Area, p. 8

pedestrian in zones 30, but pedestrians have priority in zones 20. In this case, the installation of zone 20 inside zone 30 means changes in the norms of circulation: in zones 30 cars have priority, in zones 20 pedestrians, so it is important to attract drivers attention to this fact by placing an “End of zone” sign next to the sign which marks the beginning of a new zone. CERTU (2009) provides a set of principles for zones 20, among them the belief that street “speaks” not with signage, but with its history, pedestrians are to have priority and visual contact between street actors should be favored, illusion of insecurity created by the lack of signage actually promotes safeness, difference in speed between road users should be decreased and car may be a solution, not necessarily a problem.

Parking inside zones 20 is not desirable, but needs of local residents should be respected, so some parking lots are permitted.

In Seixal recent plan for cycle facilities defines zones with 20km/h speed limit as “Rua Mista” (Mixed use street), what corresponds to the general idea of zone 20. The same plan highlights the need of vertical signs at zone’s entrance and exit, however, model signs represented in the plan, in spite of showing pedestrians, cars and houses and thus illustrating mixed use, do not have the number “20” as a mark of speed limit, what can cause certain misunderstanding among drivers.

It is important to accept universal logo (at least at the scale of one city) to delimitate the zones.

To sum up, zones 20 are suitable in areas where traffic function is not primary and there is a need to transform an area into a social space, what is impossible without the introduction of speed limits. Apart from that, changes in spatial layout also influence significantly drivers’ behavior and in cases when lack of traffic signage causes uncertainty and the priority on the road is no longer clear, drivers generally tend to slow down and drive with more caution, especially if there are other traffic calming measures implemented on a street.

PROPOSAL FOR WOONERF ZONE SIGN IN SEIXAL



Image source: Arede, H. et al. (ca. 2010)

2.3. Traffic calming measures frequently applied in zones 20 and 30

As it has already been mentioned, installation of zones 20 and 30 often requires not only speed limit sign, but also some changes in the surrounding environment. Appropriate street design enforces the drivers to respect the existing speed limit and is crucial in cases of a long straight streets where drivers will often speed up unless special traffic calming measures are introduced. Besides, street design allows to differentiate zone 20/30 from other areas, highlighting its special aspects as a residential zone, for example. Physical alterations on the road induce speed reduction, so drivers are becoming more attentive, less severe accidents and improved facilities for pedestrians and cyclists. Taking this into consideration, it is important to give overall assessment of traffic calming measures frequently applied in zones 20 and 30.

Basically, these measures can be divided into following categories:

- elevated pavement areas;
- roadway reduction;
- traffic diverters;
- surface alterations;

One of these measures from first category are speed bumps: “raised area in the roadway pavement surface extending transversely across the travel way”⁵¹. Typically, speed bumps have height of 7.5-15 cm. Similar to speed bumps are speed humps, which are installed across the whole roadway and are often 7.5-10 cm high. In order to maintain the speed limit, distance between speed humps should be relatively small: between 90 and 180 meters. Configuration of a speed hump may be round or flat (speed table). Both speed bumps and speed humps must be accompanied with vertical or horizontal signs on the road warning the drivers and should be visible at night. Speed hump can be often united with elevated pedestrian crossings, but in this case it should be wide enough and flat on top. Raised pedestrian crossings are great solution for people with reduced mobility since difficulties connected with going down or up the curb are eliminated.

⁵¹ Federal Highway Administration (1994) National Bicycling and Walking Study, p. 6

Intersection hump is another common practice which allows to lower speeds at intersections. In this case, area next to intersection is elevated to the level of curb and a ramp is installed on each exit. Since sidewalks and roadway are on the same level, it is very important to delimit them by physical barriers or visually by using different colors/materials. Besides, ramps should also be noticeable and easy to identify.

Concerning the second category, measures included in it suggest reducing space for vehicles, giving space to pedestrian facilities cycle lane, decorative elements or parking.

Street narrowing (narrowing the roadway on a short distance) is a frequently used means for speed reduction which forces the drivers to slow down and sometimes form a unique lane on the roadway (this refers to one-lane or two-lane slow points in particular). When one-lane slow point is applied, two-line roadway is limited to one line only on a selected segment of road with traffic moving in both directions. In contrast to this, two-lane slow point provides separate lines for vehicles moving in different directions. Singing should be provided to indicate flow priorities.

STREET NARROWING

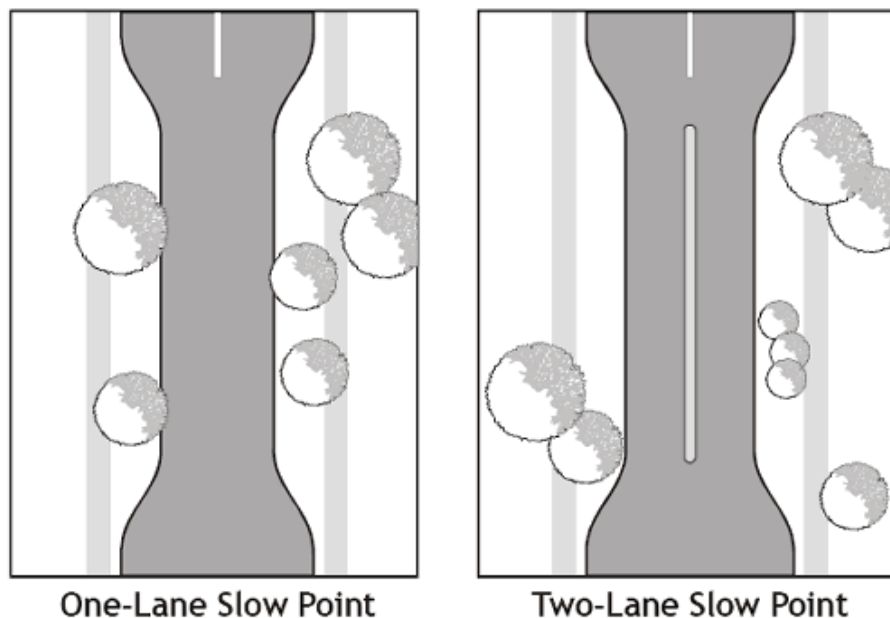


Image source: www.fhwa.dot.gov

However, these measures may cause some problems for cyclists, as once the roadway becomes narrowed, it is difficult for them to go in front of a car to pass through the segment. Besides, drivers often do not allow them to do so. In such situations, it is advised to install speed bumps before the slow point as drivers who drive slowly are more inclined to give way to cyclists. If the number bicycles in a zone is elevated it is better to make separate cycle lane for them. Slow points are often avoided by heavy vehicles and trucks but may also cause problems for passage of emergency services. In these cases it is possible to elevate slow point segment to the level of a sidewalk. It is also important to notice that these techniques are recommended for streets where traffic flow does not exceed 4000-5000 vehicles per day, otherwise serious delays are likely to appear.

Street narrowing is frequently complemented by speed bumps and is often applied on pedestrian crossings, thus allowing to shorten the distance of crossing for pedestrian.

Probably the most common example of street narrowing is the introduction of curb extensions. Curb extensions are “extensions of the curb line into the street, reallocating a portion of street space to pedestrians or ancillary uses”⁵²

CURB EXTENSIONS

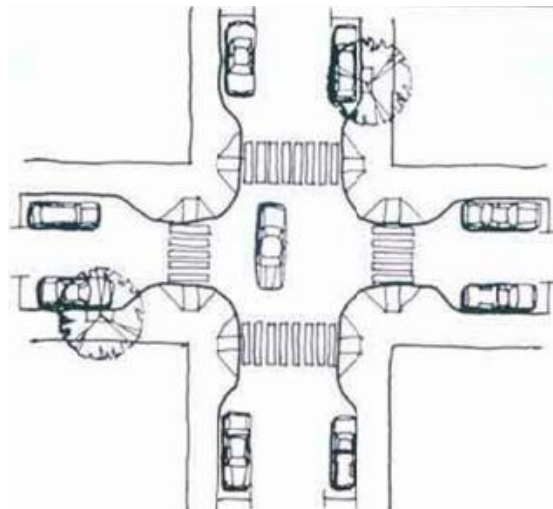


Image source: streetswiki.wikispaces.com

⁵² <http://streetswiki.wikispaces.com/Curb+Extensions>

Curb extensions force the drivers to slow down and be more attentive to pedestrians, while for pedestrians curb extensions reduce the crossing distance. When applied on intersections, curb extensions significantly reduce the turning speed. Besides, curb extensions provide place for greenery and street furniture and define parking space.

Chicanes are “sidewalk extensions that jog from one side of a street to the other to replicate such a circuitous route”⁵³. This technique is particularly suitable for narrow roads to discourage the drivers from speeding up. Due to a physical barrier and sometimes limited view drivers have to slow down. Chicanes can visually improve a street, allowing space for greenery or decorations. In other cases, chicanes can be formed by combining parallel and diagonal parking.

The third category includes measures that allow altering the direction and dissemination of traffic flows in the area and are frequently aimed to exclude direct passage through a zone and to reduce vehicle number on overloaded streets. These measures should be part of a broader plan for the whole area, as diverters implemented solely may result in simple re-dislocation of congestion. Diagonal diverters divide an intersection into two parts, forming two disconnected streets. Bollards separate these streets, so passage of vehicles is no longer possible but cyclists can pass as well as emergency services since bollards are removable. This scheme, however, may be inconvenient for local residents.

⁵³ <http://www.pps.org/reference/livememtraffic/>

DIAGONAL DIVERTERS

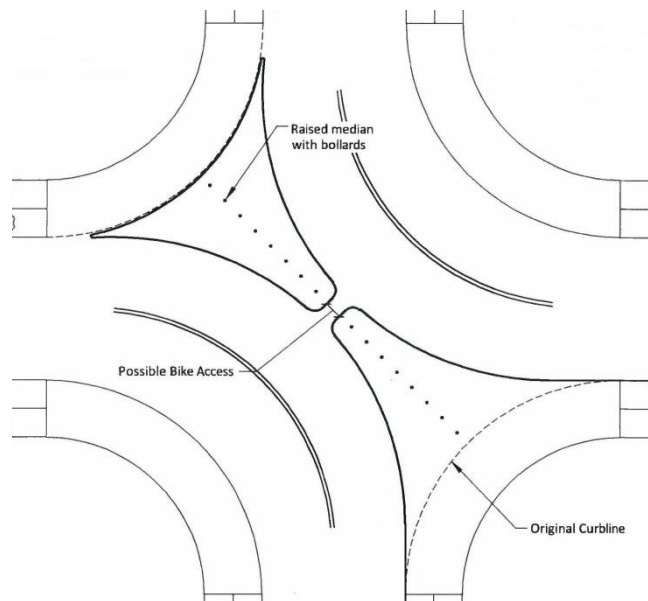


Image source: upload.wikimedia.org/wikipedia

Turning movement diverters (forced turn islands) are implemented on an intersection of a residential street with major urban axis to discourage thorough traffic. These diverters mark entrance to the neighborhood and allow one-way turn only.

TURINING MOVEMENT DIVERTERS

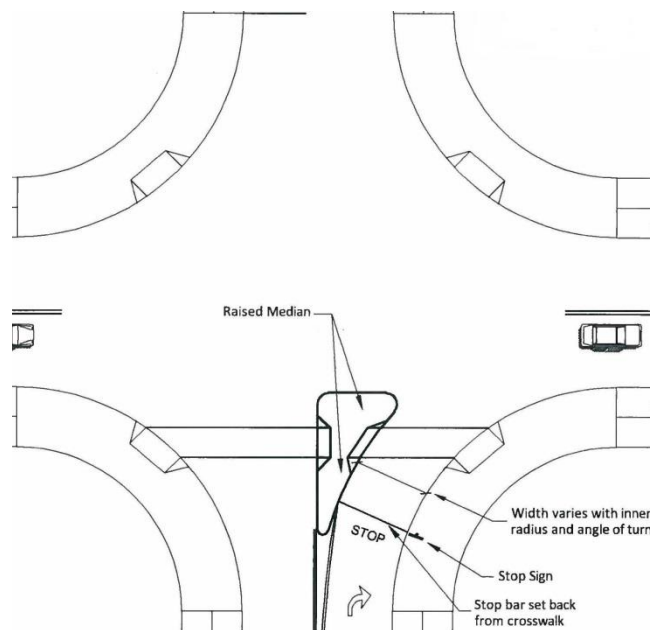


Image source: upload.wikimedia.org/wikipedia

Road surface can also be used in the context of traffic calming. Different pavement surface allows to visually distinguish pedestrian crossing or sidewalk from roadway what is important when traditional curb lines are not used. Besides, some of these treatments also provide audible cues about traffic calmed area, for example, stripes made of broken granite provoke vibration and noise inside a car, forcing the driver to slow down. In comparison to the measures described above, road surface changes are cheaper, easier and faster to install, do not reduce parking, do not complicate the passage of emergency services or functioning or drainage system. Measures like pavement marking, signing, textured or colored pavement, rumble strips may result in speed reduction as side lines visually reduce the width of a roadway, so drivers tend to slow down. Stripes may be introduced at the center of a roadway or/and at the edges.

The measures described allow to make an area friendlier for pedestrians and cyclists. Once these treatments are applied, vertical signage is not compulsory and in many cases can be avoided, thus improving visual aspect of a street.

CHAPTER 3. CONSEQUENCES OF PEDESTRIAN PRIORITY ZONES' INSTALLATION

3.1. Impacts of traffic calmed areas on local transport system

Speed has always been a concern for transport planners, especially in urban environment due to its complexity which includes various users, areas and routes different in their functionality.

Naturally, there are many positive aspects of speed, like reduced travelling time in particular, which made emergency services much more efficient and generally allowed people to be more mobile. However, this is accompanied by certain negative

consequences caused by speed, which are, first of all, accidents, including fatal, pollution and degradation of urban environment.

Research conducted by Nilsson (2004) resulted in the following model, which demonstrates the correlation between speed alternations and accidents rate in urban environment:

NILSSON'S MODEL

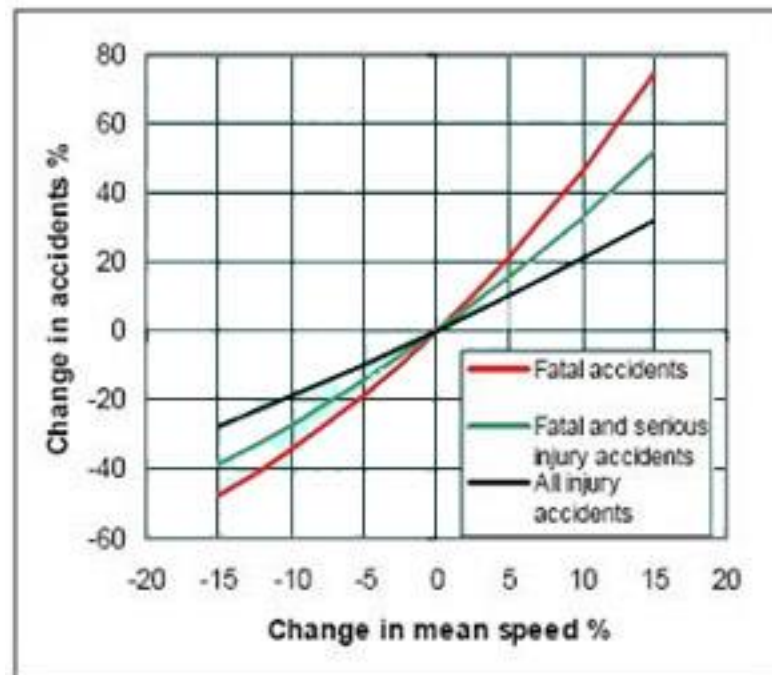


Image source: www.ors-wa.com.au

High speeds may cause some negative outcomes in urban environment, mostly connected with discomfort and danger (actual and perceived). Rapidly moving vehicle traffic makes it difficult to cross the road, especially for aged people and children, and fear of fast traffic can dissuade people from going out on the street, making public space empty. Therefore, there is inverse correlation between traffic speed and rates of walking and cycling: increased traffic speed provokes decrease in cycling and walking rates, and vice versa. As a consequence, introducing speed limit favors modal shift to sustainable transportation modes.

Simultaneously, it is well known that cycling rates and number of pedestrians depend greatly on the quality of urban environment, existence or absence of necessary infrastructure and safety levels. Thus, many cyclists prefer to longer routes with separated cycle lanes to shorter routes without cycling infrastructure. Lowering speed makes cycling and walking safer, so in a way zones 20 and 30 promote modal shift to alternative transportation modes. For example, introduction of zones 30 in Buxtehude (Germany) was followed by double increase in the number of cycle trips in 4 years. Concerning walking, lowering the speed limit from 50 km/h to 30 km/h results in the average increase by 12% in walking rates⁵⁴, though this number varies depending on each case in particular. A study conducted in Glasgow which included counting pedestrians and questionnaires diffusion showed that after the implementation of 30 km/h speed limit 20% of respondents claimed walking more. In addition to that, in London's suburban areas zones 30 were able to provide average decrease of 15% in traffic flow, even though in certain areas a 52% decrease was observed⁵⁵.

Another interesting observation in London concerned cycle flow after implementation of zones 30. There are approximately 400 zones 30 in the city nowadays and the majority of them incorporates traffic calming measures. Following the installation of these zones the number of cycling trips during peak hours grew by 123%⁵⁶ between 2001 and 2009. Apart from this, in Denmark, the Netherlands and Germany traffic calming measures like raised crosswalks and street narrowing allowed to increase cycling speed and pedestrians' speed relatively to the speed of driving.

In addition to that, lowering speed may ease congestion problems in the area. At lower speeds, distance between vehicles can be significantly reduced as they need less space for maneuver than at higher speeds, so more vehicles can be accommodated on a street. Due to lower congestion rates, delays on public transport service are unlikely to

⁵⁴ FEVR (2013) Why 30 km/h? p. 4

⁵⁵ Webster, D. C., Layfield, R. E. (2003) Review of 20 mph Zones in London Boroughs, p. 26

⁵⁶ Cedeño Tovar, M., Kilbane-Dawe, I. (2013) Effect of 20 km/h zones on walking and cycling, p. 4

become more common in zones 30, besides, it has been estimated that frequently slow boarding, and not speed, is the main reason for delays on public transport.

Speed limit is not the only factor which can provoke delays in different services. Traffic calming measures installed in zones 20 or 30 may also slow down emergency vehicles. Research in the UK showed that greater delays (1,3 – 10,7 seconds⁵⁷) are caused by roundabouts, while speed humps provoke delays of 9.4 seconds maximum. There are, however, possibilities to “reconcile” traffic calming measures with emergency needs. For example, speed bumps installed in Clark County (United States) as means to reduce traffic speed near schools have wheel track channels in the middle of bumps to be used by emergency vehicles (speed lumps).

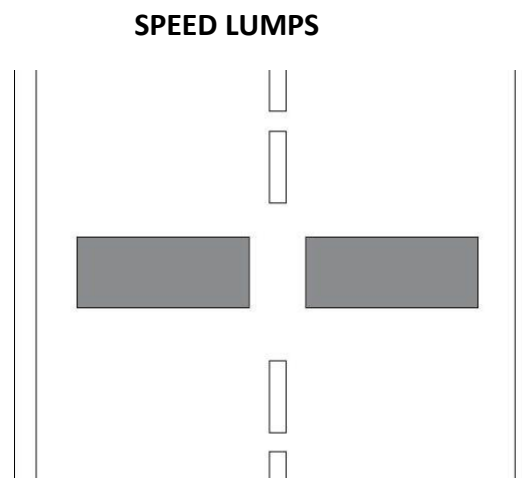


Image source: author

Other vehicles are supposed to use the bump regularly and slow down before it. With this technique time of response of emergency services is maximum 1-2 seconds more than usual (the delay is caused by the necessity to adjust the vehicle to the wheel track).

A research in Manchester concerned 6 zones 20 and showed that the number of collisions reduced by 30% - 100% and levels of traffic decreased by 17%. In the case of

⁵⁷ RoSPA (2012) 20 mph Zones and Speed Limits, p. 11

Eindhoven and Rijswijk (the Netherlands) the level of traffic decreased by 12%⁵⁸. Concerning the driving speed in these two cities, highest average speed was 21.8 km/h for motor vehicles and 27.5 for mopeds. On a national scale, speed in woonerven in the Netherlands varies between 13 km/h and 25 km/h.

Thus, similarly to the case of zones 30, some drivers do not follow the speed limit, even though overspeeding for car drivers is not really high. Despite the fact that residents did not notice changes in speed, they still strongly favored 20 km/h zones. Increase in walking or cycling was not observed. It should be noted that there is more probability of increase in pedestrian flows if the presence of pedestrians and their priority is obvious for other road users, for example, when pedestrian infrastructure is in place or number of pedestrians exceeds the number of other users. Distinction between major traffic axis and other vias should be understood intuitively with the help of appropriate street design:

Speed limits are more efficient once complemented with self-explaining street, in other words, when drivers immediately notice that they are not on a highway anymore. In the Netherlands, street sign at the entrances to woonerven deliberately does have speed limit indication, but vehicles are supposed to ride at walking pace and appearance of residential streets is enforcing this rule. With high numbers of pedestrians car drivers are more likely to give them the right of way⁵⁹. Research of a shared space on an intersection in Ashford (the United Kingdom) evidenced that in 72% of cases pedestrians were giving the right of way to vehicles, and in 20% of conflicts the right of way was given to pedestrians by vehicles⁶⁰ but in 17% of these cases pedestrians were running while crossing the street.

Nevertheless, speed limits are sometimes neglected by the drivers, for instance, in the United Kingdom half of the drivers admitted driving faster than it was prescribed, even though between 43% and 57% of drivers actually approve of zones 30 and traffic calming

⁵⁸ SWOV (1985) Reclassification and Reconstruction of Urban Roads in the Netherlands: effects on safety, the environment and commerce, p. 15

⁵⁹ Moody, S., Melia, S. (2013) Shared Space – Research, Policy and Problems, p. 3

⁶⁰ Moody, S., Melia, S. (2013) Shared Space – Research, Policy and Problems, p. 5

measures. This leads to a consideration that some drivers, in spite of supporting traffic calmed areas formally, in fact often neglect the rules.

However, speed limits in residential areas can ameliorate transport situation in a zone, since they reduce congestion and often lead to modal shift to alternative transportation modes like cycling, public transport or walking.

WOONERF DESIGN

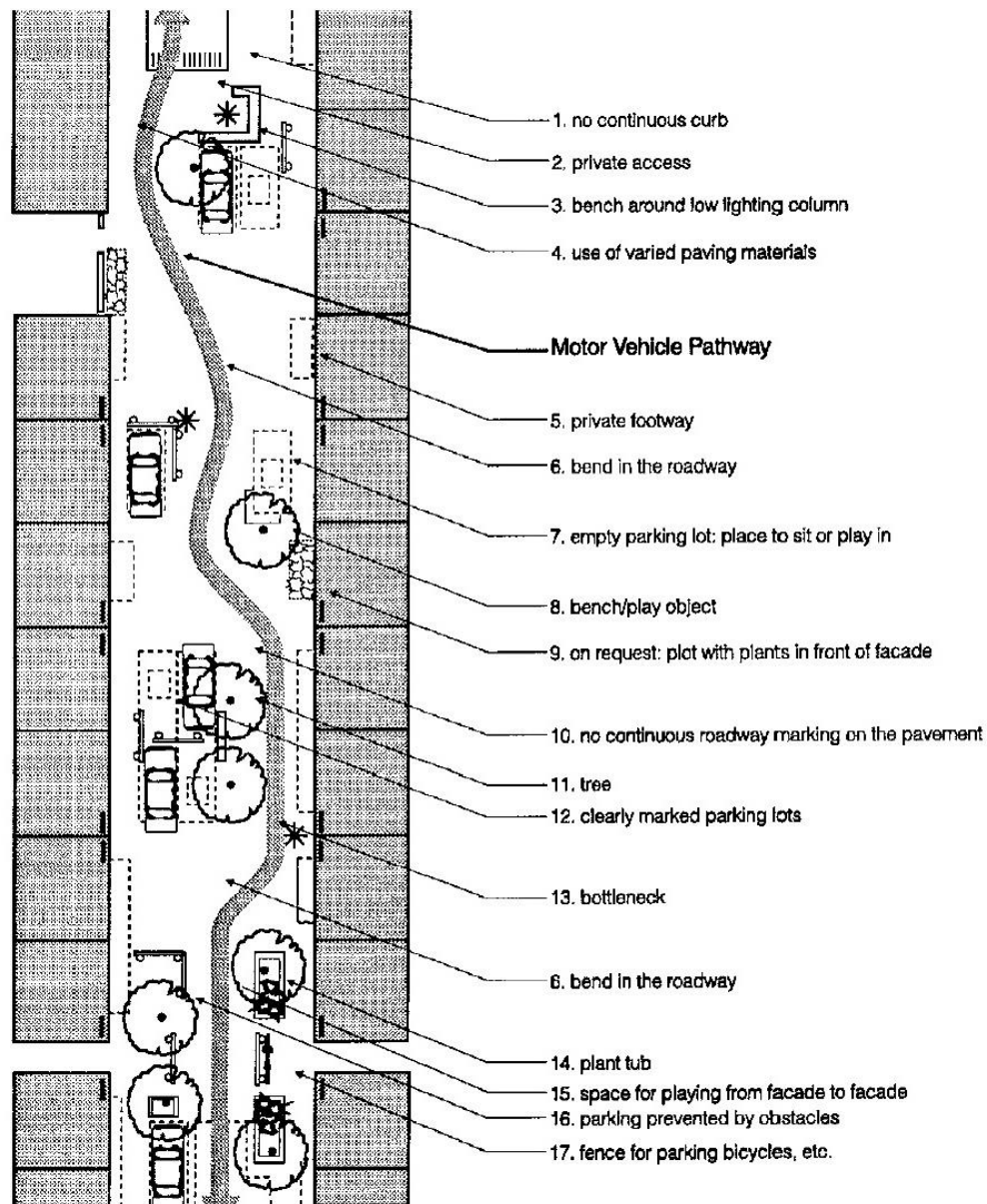


Image source: www.fhwa.dot.gov

3.2. Impacts of traffic calmed areas on atmospheric and noise pollution

Transport continues to be responsible for significant part of emissions, for example, in European Economic Area 19,5% of total emissions are produced by transport sector, with 94% of these being attributed to road transport. CO₂ is recognized as a main element of transport greenhouse gas emissions, accounting for 99% of these⁶¹. Thus, initiatives aimed to reduce the level of emissions should be promoted.

Even though it is believed that emissions tend to reduce at lower speeds, impacts of zones 20 and zones 30 on the environment can hardly be measured precisely due to numerous factors that affect this parameter. There are, however, certain regularities connected with vehicle's speed which permit to evaluate approximately the influence of zones 20 and 30 on the environment.

There are several types of pollutants associated with vehicle traffic, in particular carbon dioxide (CO₂), partially responsible for the greenhouse effect and global warming. The amount of CO₂ in the atmosphere depends on fuel consumption: more fuel consumption leads to more CO₂ emissions. Carbon dioxide and carbon monoxide (CO) emissions are highest at low traffic speed (15 km/h or less⁶²), while hydrocarbons, on the contrary, reduce proportionally to the reduction of speed, so are less at lower speeds. Carbon monoxide emissions are less on medium speeds (around 50 km/h⁶³). Other pollutants are oxides of nitrogen (NO_x), consequence of high engine operating temperatures, so these generally more present if the vehicle is driven at high speeds over long periods of time. It was established that, on the average, lowering speed limit from 50 km/h to 30 km/h decreases CO₂ emissions by 15%, NO_x by 40% and carbon monoxide by

⁶¹ <http://www.eea.europa.eu/themes/transport/speed-limits>

⁶² OECD-ECMT (2006) Speed management, p. 43

⁶³ OECD-ECMT (2006) Speed management, p. 43

45%⁶⁴. Thus, pollutant emissions vary greatly according to the type of pollutant, however, driving style also plays an important role. It was established that sharp braking and/or sudden acceleration provoke general increase in pollutant emissions⁶⁵, so traffic calming measures applied in speed limit zones may actually provoke negative consequences in the levels of pollution. Though it is not easy to balance emission levels, it is believed they are optimized when speed is approximately 40-90 km/h for light vehicles and 50-70 km/h for trucks and buses⁶⁶. In addition to that, level of emissions also depends on the temperature outside, and increases if the temperature is high. This is particularly true in the case of CO emissions, which varies greatly during the day, depending on the level of traffic and local meteorological conditions. To address this problem, French authorities introduce temporary speed limit of 20 km/h when air quality is poor, though this measures are often neglected by the drivers since normally applied traffic signage remains in place and drivers are sometimes confused. Similar practice is observed sometimes in Belgium, where temporary “Smog” signs are installed once air pollution gets high and roads with speed limit of 70 km/h switch to 50 km/h speed limit.

It should also be mentioned that introduction of speed limits may reduce fuel consumption. As an example, a vehicle driven at 90 km/h consumes 23% less fuel than a vehicle moving at 110 km/h⁶⁷, similarly, driving at 40 km/h consumes less fuel than driving at 50 km/h, what leads to suggestion that 20km/h or 30 km/h speed limit might reduce fuel consumption, even though there is not enough research in this field to draw final conclusions. Besides, driving style also influences fuel consumption: aggressive driving may lead to 30% increase in resource consumption, whereas in zones with speed limit and traffic calming measures drivers are inclined to drive with caution. Thus, zones with speed limit of 30 km/h permit to optimize the use of non-renewable resources.

⁶⁴ The European Federation for Transport and Environment (2001) Why 30 km/h Limit? p. 3

⁶⁵ OECD-ECMT (2006) Speed management, p. 44

⁶⁶ OECD-ECMT (2006) Speed management, p. 43

⁶⁷ OECD-ECMT (2006) Speed management, p. 44

Concerning the problem of noise in urban areas, it is generally understandable that lower speeds lead to less noise, though braking or acceleration and vehicle type are also relevant in this context: for example, older cars or large trucks tend to be noisier. This is especially relevant when speed limit is accompanied by traffic calming measures as constant braking or acceleration of large vehicles between them may be disturbing for the neighborhood. Apart from that, sometimes an increase by 3 dB is observed in the areas of proximity to zones with speed limit. The sources of noise are predominantly the noise from the working engines and the noise produced by contact of tires with road surface. It was found out that two times speed increase results in 12 dB increase in noise levels⁶⁸, and installation of zone 30 allows to cut down traffic noise by about 3-6 dB compared to 50 km/h zone, so 5 cars in zone 50 produce same amount of noise as 10 cars in zone 30.

Thus installation of 30 km/h zones permits to reduce traffic noise by 3-6 decibels⁶⁹ in comparison to 50km/h limit, what makes it easier to notice a dangerous situation, however, some studies claim that this reduction is not noticed by the residents. At the same time, in some cases an increase in the levels of noise of around 3 decibels is observed in the neighboring areas. To illustrate these figures, it is worth mentioning that 5 cars in zone with speed limit of 50 km/h produce same levels of noise as 10 cars in 30 km/h zone⁷⁰. At the same time though it should be noted that once traffic is less present in the area, it becomes more attractive and secure place for children to play, and some residents may complain about the noise of children playing outside. Still, this kind of noise is present only in day hours, so the area is quieter during the night.

To sum up, there is clear evidence that speed limits are able to reduce noise levels. Concerning atmospheric pollution, there are many factors to consider while evaluating the effect of zones 20 and 30. Besides, one may suggest that speed limits allow reducing fuel consumption. In its turn, the level of CO₂ emissions depends on fuel consumption, so less fuel used leads to less CO₂ emissions, thus speed limits can potentially decrease levels of

⁶⁸ OECD-ECMT (2006) Speed management, p. 45

⁶⁹ FEVR (2013) Why 30 km/h? p. 4

⁷⁰ The European Federation for Transport and Environment (2001) Lower Urban Speed Limits, p. 2

CO2. It should also be highlighted that since the use of private vehicle is not favored in traffic calmed areas, general improvement of local environment is possible due to little presence of traffic.

3.3. Impacts of traffic calmed areas on the community

In the majority of cases modern residential areas were designed accounting for automobile use, thus they have linear structure and provide good view distance. This scheme makes them comfortable for driving and even favors speeding in some cases, so residential neighborhoods sometimes are not convenient for recreational use. Changes in street design coupled with speed limits may result in more vital and livable area. As it has been noted above, changes in physical layout of a street are common in zones 20 than zones 30. It has to be said though that evaluation of zones 20 may be a hard task since too many parameters should be accounted for. For instance, it is hard to measure the effect of a particular traffic calming measure because it is normally introduced together with other similar interventions. Above all, zones 20 design varies from location and context, so generalizing results from introduction of speed limits should be made with caution.

Concerning the installation of shared space, local residents are often reluctant to the idea, fearing that it would make public space more dangerous and less comfortable. In order to make public attitude more favorable, local community should be informed in advance about the aims of speed limits of 20 km/h or 30 km/h and how their installation may affect the neighborhood. It is also advised to hold public reunions with local residents and involve them in the design process.

In Haren (the Netherlands), local shop owners were preoccupied that without proper signage car owners would park too close to the entrance to the shops, but in the end ramps for bicycle parking were used to delimitate space for car parking. At the same time, some cyclists found the shared space disturbing since with its introduction separate cycle lanes were removed, so cyclists are “pulled” by cars to the side of the road and

choose to cycle on the edge (near parked cars or street furniture) or even sidewalk. Shared space concept is based on the supposition that illusion of risk, created by traffic signage removal, would urge people to interact with each other. Thus, shared space may seem to be dangerous but is relatively safe in fact. However, some cyclists are not comfortable with riding in an area with high level of perceived risk, even though in the majority of cases they have priority over vehicles. The situation gets even more complicated once public transport is present, as buses, for instance, are hard to override due to their size, and it is not pleasant to cycle next to a bus. Some cyclists even claimed that if shared space zone in Haren was not relatively small, they would rather use longer routes with cycling infrastructure than pass through shared space. This refers to elderly cyclists in particular, who do not feel confident enough in such environment.

Apart from this category, other vulnerable users may find it difficult to use shared space. It is assumed that in case of danger road users will interact with each other and react accordingly, however, mentally disabled people, people with poor vision, children and elderly may not respond to risks quickly and correctly, and consequently find shared space disturbing practice. Thus after introducing woonerf in Drachten (the Netherlands) older population was the only group to evaluate negatively safety on the site, with 10% of respondents from this group claiming that the place became more dangerous than it used to be⁷¹. As a result, it seems that sometimes the core idea of woonerf is working against it, in other words, woonerf is supposed to be safe because it seems to be unsafe, but it turns out that this is the reason why some people do not like it: they prefer environment which looks like and is perceived as safe. However, often removing traffic signage actually makes place safer: before the installation of woonerf in Drachten, eight accidents were registered on the intersection between 1998 and 2002, five of them caused injuries, whereas after woonerf has been implemented, no accidents were registered⁷². Overall, approximately 70% of Dutch population approve of woonerven and find them attractive,

⁷¹ Clarke, E. (2006) Shared Space – The Alternative Approach to calming traffic, p. 292

⁷² Clarke, E. (2006) Shared Space – The Alternative Approach to calming traffic, p. 292

with non-motorized users generally being more favorable to the concept than non-motorized⁷³.

Whereas shared space normally results in lower rates of registered accidents, there are people who complain that the number of “almost accidents”, which are not registered, actually increased, so sometimes people avoid accident in the last moment. Studies of woonerfs in Eindhoven and Rijswijk (the Netherlands) showed that accidents involving motor vehicles actually decreased, however, this trend was not observed in collisions involving bicycles or scooters⁷⁴. As it has been mentioned above, average highest speed of scooters and mopeds in woonerf is about 27 km/h, so it is almost 10 km/h more than the limit. Same problem may often be caused by cyclists, as some users (for example, young people) do not always comply with speed limit of 20 km/h.

It is also important to notice that in the case of Haren, there are no speed limit signs at the entrance to shared space, what means that allowed speed for vehicles is 50 km/h. Besides, in Haren, pedestrian crossings had to be installed in response to residents' demands. Pedestrians were complaining that cars were not actually sharing space with them, they had to wait for a pause in traffic flow to quickly run over the street and sometimes it was hard to understand whether a car was going to stop or not. This is how a respondent from Scotland who is living in shared space area described this phenomena: “9 out of 10 cars would stop for me. My difficulty is recognizing the 10th”⁷⁵

In the United Kingdom, a survey conducted to evaluate the effect of zones 20 (homezones) showed that 73% of respondents approved of zone installation and noted its positive impact on the area's appearance, 74% believed that homezones made walking and cycling safer, and 64% favored the implementation of these zones. However, these are average figures for the whole country, and it has been noted that the success of

⁷³ Federal Highway Administration (1994) National Bicycling and Walking Study, p. 10

⁷⁴ SWOV (1985) Reclassification and Reconstruction of Urban Roads in the Netherlands: effects on safety, the environment and commerce, p. 12

⁷⁵ <http://www.aviewfromthecyclepath.com/2008/11/shared-space.html>

particular schemes varies greatly. In Ashford's case, mentioned above, 80% of respondents would prefer previous layout of the intersection with traffic lights and formal signage⁷⁶ to shared space, 83% of those that use intersection on a daily basis claimed they would like to return to traditional intersection design.

Concerning woonerf's influence on commercial activities, there is not much data provided, however, in Poynton half of local shops was abandoned before the implementation of a concept, whereas two years after it was introduced all shops were opened⁷⁷. This may be explained partially by attractiveness of woonerf to pedestrians: slow traffic and low traffic volumes create pleasant atmosphere for walking trips. At the same time, people who shop walking spend two times more money than those who shop with car⁷⁸.

An evaluation carried out in the United Kingdom showed that in zones 30 accidents rate is generally reduced by about 60% and accidents involving kids decreased by 67%. In Hull (the UK) a decrease of 56% was observed in overall accidents rate, whereas for serious and fatal accidents the decrease constituted 90%, while in two neighboring towns, Yorkshire and Humberside, number of traffic casualties rose by 1,5% between 1994 and 2001. Inside zones 30 number of collisions diminished by 56%, pedestrian casualties in particular went down by 54% and child pedestrian casualties decreased by 74%. Groups that benefited the most from the introduction of 30 km/h limit are children and pedestrians. In London in particular, a 42% reduction⁷⁹ in injuries was noted after implementation of zones 30. Concerning the implementation of zones 20, these provoked about 40% decrease in the casualties' rate and number of collisions. Accidents involving cyclists were reduced by 16.9% and there was no significant rise in the number of

⁷⁶ Moody, S., Melia, S. (2013) Shared Space – Research, Policy and Problems, p. 7

⁷⁷ Gibson, J. (2014) How to reimagine our streets around the concept of shared space?

⁷⁸ Campaign for Better Transport (2009) A Transport Agenda for Outer London, p. 6

⁷⁹ Madruga, P. et al. (ca. 2010) Analysis of 30 km/h Zones, p. 11

casualties on neighboring streets⁸⁰, on the contrary, sometimes adjacent areas showed 3% reduction in casualties. Latest research shows that zones 20 were responsible for an annual 6% decrease in general casualties' rate in the city. In Denmark 30 km/h speed limit resulted in approximately 10% reduction in the number of fatal accidents per km⁸¹. As a rule, when 50 km/h speed limit is reduced to 30 km/h, accidents rate falls by 25%⁸². Over the period of the last 20 years an annual decline of 1,7% in road casualties was registered in London, whereas in zones 30 this number reached 42% .

Overall, it is natural that in different contexts and conditions traffic calmed areas produce different outcomes in the community. Besides, communities, far from being homogeneous, unite people from various age groups and health conditions, so some members (elderly people, disabled) may find traffic calmed areas and especially woonerven difficult to use/navigate. However, traffic accidents in the vast majority of cases, are becoming rare after zones' implementation, making area safer for everybody.

CHAPTER 4. CASE STUDY: BAIXA OF LISBON

4.1. General information about the area of Baixa

The following chapter is dedicated to pedestrian streets in central Lisbon, in particular, in the area of Baixa. The case is interesting since it is historical city center, which specific characteristics and unique architectural value. Still, some trends, for example, urban decay which was mentioned in previous chapters is also present in Baixa. As in many European cities, pedestrianisation here was viewed as a way to struggle against traffic congestion and to revitalize the area. Taking this into consideration, it might be said that the case of Baixa is a typical example of pedestrian streets implementation.

⁸⁰ <http://www.bmj.com/content/339/bmj.b4469>

⁸¹ FEVR (2013) Why 30 km/h? p. 4

⁸² SWOV (2010) Zones 30: Urban Residential Areas, p. 2

However, there are some particularities, connected with history of the zone and current policies of Lisbon City Council which are to be explored. Besides, the chapter will include some ponderation on the applicability of shared space concept in Baixa. Limits of the study field are Rua dos Fanqueiros, Rua do Crucifixo, Rossio e Praça do Comércio.

These study limits were chosen since these streets are affected the most by pedestrianization project.

Baixa is an area in central Lisbon, occupying approximately 235,620 sq m. In the North the area is limited by Rua da Betesga, in the South by Rua do Arsenal, thus being located between two important city squares: Praça do Comércio and Rossio, which are connected by the streets of Baixa (orientation North-South). Western and Eastern limits are, correspondingly, Rua do Crucifixo and Rua da Madalena. The area is relatively plain (inclination degree is 0-5%)⁸³, since it is located on the site where two river flows were entering Tejo. However, externally Baixa is surrounded by hills of Castelo on the East and São Francisco on the West. Thus, the area is located in juxtaposition with neighborhoods of Alfama and Chiado, both highly attractive for tourists due to their historical value and authentic atmosphere. Moreover, Chiado is a vivid commercial area where numerous shops and boutiques are located, together with Armazéns do Chiado commercial center. Situated between these two particular neighborhoods, Baixa mixes their main characteristics, being both commercial and traditional, authentic. Currently the area of Baixa Pombalina makes part of Freguesia de Santa Maria Maior, though before 2012 large area of Baixa was included in Freguesia de São Nicolau.

Baixa in its modern design was elaborated by Manuel da Maia, Eugénio dos Santos e Carlos Mardel under the supervision of Marques de Pombal after the earthquake of 1755. Revolutionary approach at those times consisted in constructing linear and perfectly organized blocks of connected buildings, all having similar height and dimensions. The result was modern geometry of Baixa with streets parallel or perpendicular to each other.

⁸³ Cristina da Costa Lopes, N. (2009) A Influência das Características físicas do Território na Morfologia Urbana. Contribuição para uma Análise da Forma Urbana no Concelho de Lisboa, p. 27

Built from zero after strong earthquake of 1755, Baixa of Lisbon congregates major activities on a national level, hosting numerous financial and public institutions, businesses and retail trade. Rua de Comércio and rua de São Julião were predominantly commercial, and starting from rua da Conceição buildings were mostly for residential use, having facilities on the ground floor which permitted to have there horses, carriages and, later, cars. Upper floors were inhabited. Thus the initial plan of Baixa provided for both commercial and residential use, and residential conditions were quite comfortable. In the course of history the neighborhood experienced different problems, decay and abandonment, what influenced eventually its development and the way it looks now.

Some trends which predicted the decay of Baixa started to be visible already in the second half of the XIX century when well-off population classes started to choose peripheral areas as their residential zone, preferring their organizational model, leaving city center to medium and low-income groups.

Nevertheless, Baixa was maintaining its attractiveness for business and living until large infrastructural plans started to be implemented. New infrastructure facilities made distant areas more accessible, and with growth in the number of car-ownership Baixa turned out to be less attractive for residents as it could not provide enough parking space. As the area was losing population and was becoming more abandoned, levels of safeness on the streets decreased as well, especially during the night hours, and this in turn further dissuaded people from coming to the zone.

In the 1980ies these processes were really visible in Freguesia de São Nicolau, where 21% of buildings (56 buildings) lost their residents during the decade⁸⁴. As a result, the necessity of rehabilitation program for the area was acknowledged by authorities and technicians, however, efforts were made to recuperate just some of the deteriorated buildings and these initiatives were relatively rare. Still, as these attempts were being

⁸⁴ Serdoura F., Almeida H. (2008) A Reabilitação da Baixa Pombalina de Lisboa. Uma Estratégia para a Sustentabilidade Ambiental e Económica? P. 62

made during the 1990ies, it became clear that comprehensive strategy and public-private partnership are needed for area-wide revitalization.

Overall decay of the area manifested in a number of problems that were characteristic for the area at the turn of the millennium. Research conducted in 2001 showed that 37,2% of houses were uninhabited (the figure corresponded to 966 houses⁸⁵). In addition to that, 66% of the total number of houses was rented on a permanent basis, whereas for the city of Lisbon this figure was 48%⁸⁶. Surprisingly though, this high rate of rented properties is associated neither with luxury offer (due to central location), nor with touristic accommodation. The research evidenced that about 75% of these rented properties were rented for less than 60 euros per month and this price, unnaturally modest for historic center, reveals that the quality of the offer was quite low⁸⁷.

Another paradox was low percentage of people with higher education level in the area. This refers both to workers and residents. In 2001 only 12,6%⁸⁸ of residents had higher education degree, and creative industries or knowledge-based business were hardly present in the area generally, disturbing fact for historic city center with excellent public transport facilities.

In 2008 housing was occupying 23% in the total of built area in Baixa, while 13% of buildings were abandoned⁸⁹. Other 13% were attributed to commerce and 28% to services.

Concerning local population, it consisted predominately of aged people (28,7% in 1991 and 34,9% in 2007⁹⁰). As a consequence, Baixa had low number of economically

⁸⁵ Câmara Municipal de Lisboa (2005) Baixa Pombalina: bases para uma intervenção de salvaguarda, p. 74

⁸⁶ Câmara Municipal de Lisboa (2005) Baixa Pombalina: bases para uma intervenção de salvaguarda, p. 72

⁸⁷ Câmara Municipal de Lisboa (2005) Baixa Pombalina: bases para uma intervenção de salvaguarda, p. 72

⁸⁸ Câmara Municipal de Lisboa (2005) Baixa Pombalina: bases para uma intervenção de salvaguarda, p. 73

⁸⁹ Câmara Municipal de Lisboa (2008) Revitalização da Baixa-Chiado, p. 30

active population: only 46% in 2001, what could have also influenced badly economic vitality of this zone⁹¹, as commercial trends in the area were somewhat similar to residential.

Concerning tertiary businesses, starting from 1970 they began to be relocated in the area of Avenidas Novas. As significant number of people started to work there, consequently many restaurants, shopping malls and other services emerged in that zone.

Still, up until the second half of the 1980ies Baixa-Chiado were recognized as prime shopping zones. However, the situation changed in 1985 with the opening of Amoreiras Shopping Center and Centro Comercial Fonte Nova.

Emergence of big commercial centres in more distant areas had negative impact on commerce in Baixa. New developments offered high range of goods in one place, better parking facilities, client-oriented, modern service and were closer to geographical center of a city, so were in proximity to large part of Lisbon population, whereas with urban sprawl Baixa turned out to be far away from residential neighborhoods. Besides, opening of an outlet encouraged proliferation and further diversification of commercial offer in the city and Lisbon Metropolitan area, so in this context commercial offer in Baixa seemed to be poor and people had fewer reasons to choose Baixa for shopping. Basically, Baixa did not escape the trend observed in Europe and America in 1960-70ies, when growth of urban agglomeration coupled with increase in car-ownership made shopping in historical city center uncomfortable. As in most big European cities, traditional city did not manage to be competitive in the context of urban expansion and ended up lacking functionality.

In 1988 ongoing degradation of Baixa was aggravated by fire in adjacent area of Chiado, which resulted in destroyed buildings and unpleasant environment.

In 1996 shops with clothes/ shoes together with household appliances were responsible for 28% of commercial activity in Baixa. Financial and personal services

⁹⁰ Almeida dos Santos Lago, P. (2007) A Utilização dos Quarteirões-Tipo nas Estratégias de Regeneração Urbana nos Centros Históricos, p. 127

⁹¹ Almeida dos Santos Lago, P. (2007) A Utilização dos Quarteirões-Tipo nas Estratégias de Regeneração Urbana nos Centros Históricos, p. 128

accounted for 36% of total businesses. Concerning buildings, only 15% had residential use, 31% were occupied by services and 36% - by commerce⁹².

Consumers, nowadays being quite well-informed, have become more demanding. Simultaneously, many shops in Baixa are actually small family-owned businesses, some of them being poorly qualified in the field of management and being somehow reluctant to changes, failing to adapt to new conditions.

It is important to notice that consumers who shop in Baixa typically do not reside in the area, but prefer shopping there due to specific atmosphere, easy access by public transport and enjoyment from walking in the area. This is an important characteristic of the area: as it can be observed, from a vivid commercial and residential area Baixa is becoming more and more a leisure place, so functionality of the zone is changing.

Considering the importance of commercial activities in the area, in 2001 approximately 67 000 sq m of Baixa were occupied by retail trade, giving jobs to 4610 people⁹³. Among businesses present in the area, special weight was attributed to shops of clothes (29,9% of total number of shops and 39,2% of commercial space⁹⁴). Also 17,5% of local businesses were connected with leisure and culture, and, besides, restaurants assumed great importance, occupying 12 000 sq m and giving work to 1800 people⁹⁵. Only 3% were food shops, and this poor offer was not compatible with residential function of the area⁹⁶. In addition to that, ageing of residential population created new type of demand, originating from this group (for example, demand for pharmacies). It should be noted that nowadays commerce is installed on the ground floor of initially residential buildings, where carriages and cars used to be stored before, so residential use of Baixa became more complicated. Commerce, in the beginning concentrated on rua do Comércio

⁹² Moura, D., Costa Pinto, T., Guerra, I.(1996) *Dinâmicas de Mudança na Baixa Pombalina*, p. 2

⁹³ Câmara Municipal de Lisboa (2005) *Baixa Pombalina: bases para uma intervenção de salvaguarda*, p. 84

⁹⁴ Câmara Municipal de Lisboa (2005) *Baixa Pombalina: bases para uma intervenção de salvaguarda*, p. 84

⁹⁵ Câmara Municipal de Lisboa (2005) *Baixa Pombalina: bases para uma intervenção de salvaguarda*, p. 84

⁹⁶ Câmara Municipal de Lisboa (2005) *Baixa Pombalina: bases para uma intervenção de salvaguarda*, p. 84

and rua de São Julião, is now present in the whole area, making Baixa commercially, rather than residentially, important.

Thus, the transformation of Baixa is characterized by reduction in the number of local residents (where significant predominance of aged population was observed) and increase of temporary visitors. These factors were accompanied by degradation of buildings and generally uncomfortable living in the area due to lack of residential facilities (like food shops). Large part of commercial surfaces in Baixa is occupied by tertiary sector.

In terms of mobility, Baixa is crucially important as from this area main transport arteries of the city (like Avenida da Liberdade or Avenida Almirante Reis) are originated.

However, as a historic center, Baixa was not designed accounting for automobile use. Naturally, widespread use of private vehicle affected it. In the 1930ies high levels of congestion in Baixa, caused by growth of population and motorization rates, became preoccupying for city's officials. Partial dislocation of activities and businesses from the area was proposed as a solution for the problem. It was assumed that Baixa, being historic center, would always be a desired place for business

activities and would remain commercially attractive anyway. On the other hand, encouraging commercial activities in other parts of the city would enrich it and guarantee its economic liveliness. This idea, initially considered as a win-win strategy, in fact had negative impacts on Baixa area, where economic activities were slowly coming to decay as new poles of commerce were emerging.

Still, historic evidence shows that traffic continued to be pretty hard in Baixa even with development of new avenues. In the 1950ies dimensions of Praça de Comércio were reduced in order to extend Rua Áurea and Rua da

PARKING LOT ON PRAÇA DO COMÉRCIO



Image source: mouro.info

Prata, thus letting vehicular traffic to go along the square and reach the river. Further developments were also aimed to ease traffic flow in the area (before 1990ies 40% of Praça do Comércio were left for traffic needs, whereas almost all central area of the square was a parking lot). Inside the area, major connecting axis between Rossio and Praça de Comércio (Rua Augusta) remained opened for traffic.

Later developments introduced full pedestrian malls in a number of streets in Baixa, changing traffic rules inside the area. At the moment, general traffic scheme for Baixa looks like this:

CURRENT TRAFFIC SCHEME IN BAIXA

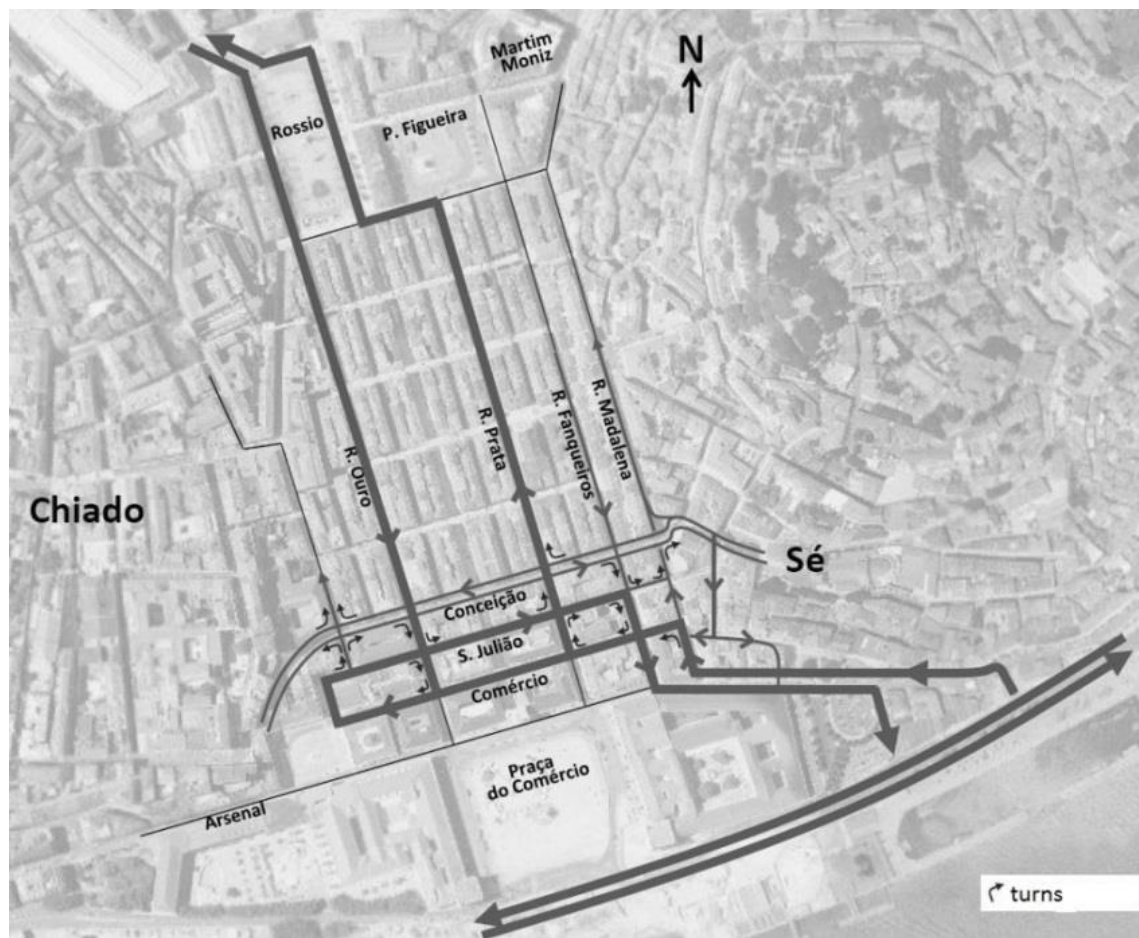


Image source: Lajas, R. (2011)

Baixa area, being plain, allows to effectuate walking trips easily, however, the connection of Baixa with adjacent zones is complicated due to hilly topography. It makes

walking between Baixa and other zones complicated, so many people prefer to use private vehicles. To sum up, the problem of walking in Baixa does not concern walking inside the area, but its connection with other sites. In order to address this issue, several mechanical facilities were installed with the aim to ease walking in the area. These facilities include: elevator Pollux, elevator Castelo, elevator Santa Justa and elevator Chão do Loureiro.

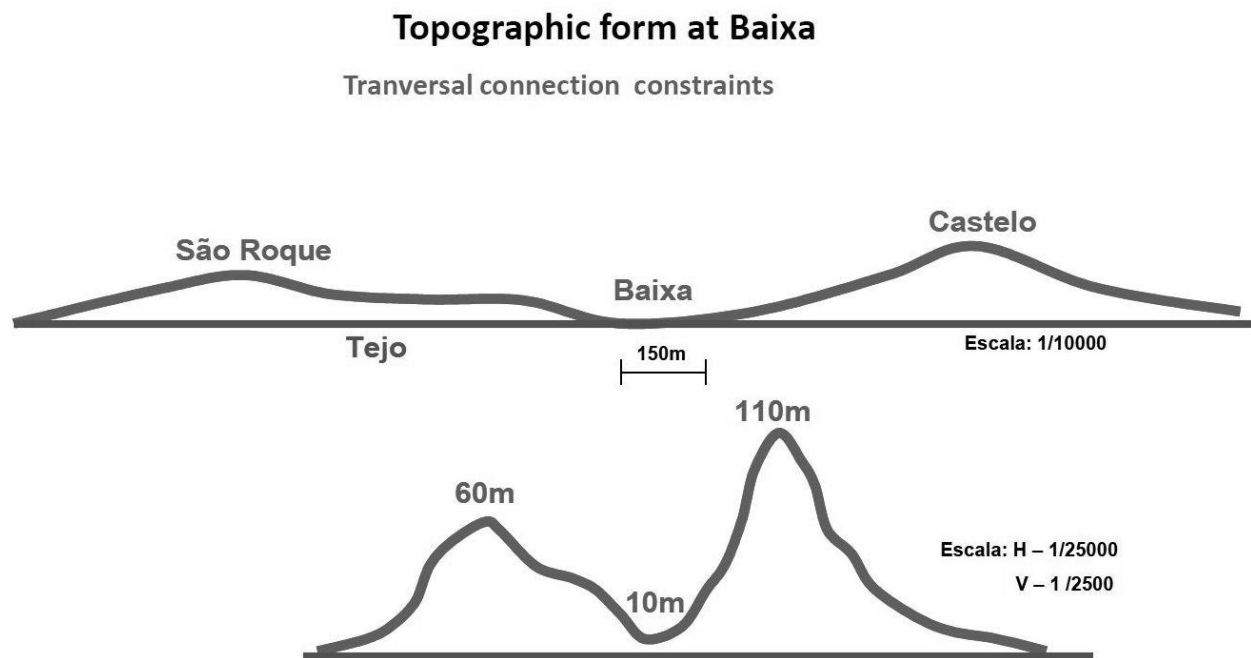


Image source: Lajas, R. (2011)

Compared to vehicular traffic, pedestrian dislocations for short distances have a number of advantages, like low environmental costs, relatively cheap basic infrastructure, low occupancy of public space.

Parking is quite complicated in the area. Nowadays, there are four underground parking lots able to accommodate 3200 vehicles⁹⁷ and parking lot Chão do Loureiro, accommodating 192 cars. These facilities are complemented by possibility to park on the street, which for now can host 1500 vehicles. Lack of parking space is a persistent problem in the area, but there is hope that current habits may change in future, as some claim that young generation tends to use less private vehicles, especially in urban environment, preferring cycling or walking. City officials in this case should foresee and

⁹⁷ Câmara Municipal de Lisboa (2008) Revitalização da Baixa-Chiado, p. 25

support this trends by introducing favorable street environment. Ex-president of Junta de Freguesia de São Nicolau highlights that traffic decreased by 45% between 2008 and 2010⁹⁸.

Concerning public transport, Baixa is recognized as a zone which is best served by public transport. There are three metro stations nearby (Rossio, Martim Moniz and Baixa-Chiado) that belong to two different metro lines (blue and green). It is also interesting how location of metro stations affected commerce on the streets of Baixa. When metro station on Praça da Figueira was the only one available, people who needed to make a connection between metro station and river station of Terreiro do Paço would go through Baixa, often using Rua dos Fanqueiros, and eventually buy things on their way. With the opening of Baixa-Chiado metro station, the distance between metro and river station was shortened, so there was no longer need to go through the whole area. Later, once metro station Terreiro do Paço was opened, this flow of people who wanted to connect and had to do so by going through Baixa disappeared from the site, reducing pedestrian flow in Baixa.

In addition to that, the area is well served by ground transportation (buses and trams). As a result, large part of trips having Baixa as destination is in fact made by public transport modes or walking, whereas vehicle traffic is mostly thorough. At the same time, thorough traffic is present in the area due to the lack of alternative routes, both in the directions North-South and East-West.

At the moment, in Lisbon there are 672 vehicles for 1000 people. Still, public transport continues to be most frequently used transportation mode, accounting for 45% of all trips⁹⁹ in 2005 in the whole city. Besides, in the case of Baixa (and historic center areas) public transport is even more dominant, as 60% of trips having Baixa as destination are made by public transport. However, there is a risk that this number will decrease since 80% of people who choose public transport claim not having available private

⁹⁸ Lam, D. (2010) Tráfego e poluição afastam moradores

⁹⁹ Câmara Municipal de Lisboa (2005) Lisboa: o Desafio da Mobilidade, p. 50

vehicle. In Lisbon 30% of trips are made by private vehicles and 23% of dislocations are pedestrian. Research conducted in 2005 revealed that in the city 38% of people choose to walk because the distance to destination is short and 31% choose walking because they enjoy it¹⁰⁰.

Concerning the motives for travelling, Baixa is the top destination for leisure/shopping trips, followed by zone of Oriente and Carnide Sul¹⁰¹. Another reason for people to go to Baixa is personal meetings (with friends/relatives/etc.). The areas of Baixa and Avenidas Novas accumulate the biggest part of all trips in Lisbon.

4.2. Municipal politics in Baixa

Recently there has been a number of initiatives that aim to promote Baixa and, fundamentally, concern three major axes of future interventions: physical, economic and social components. In 2006 Baixa applied to be selected as UNESCO's World Heritage site, thus highlighting its unique architectural and cultural value. Another important step was adoption of Revitalization program for Baixa-Chiado and Plano de Pormenor da Baixa Pombalina (2008). The first document was elaborated in 2006 and it is stipulated in the plan that due to concentration of political, administrative and financial institutions together with commercial and touristic activities, the area is not and will never be mostly residential, what means that real estate offer in the zone will be predominantly for temporary visitors like tourists, students and temporary rent.

There are, of course, critics who do not approve of favoring temporary residents in Baixa. Currently Baixa can accommodate 3000 tourists and more hotels are to be constructed, so the area will be able to accommodate 1427¹⁰² guests more (number based

¹⁰⁰ Câmara Municipal de Lisboa (2005) Lisboa: o Desafio da Mobilidade, p. 53

¹⁰¹ Câmara Municipal de Lisboa (2005) Lisboa: o Desafio da Mobilidade, p. 62

¹⁰² Braga, I. (2013) A Baixa de Lisboa está a mudar de rosto

on projects that have been approved or in course in 2013). These serve mostly foreign visitors, as the number of Portuguese visitors barely reaches 5%¹⁰³. Consequently, local shops are changing their profile in an attempt to respond to new type of demand. Some of old typical shops and small businesses in the area are being closed under the action of new rental law, which definitely attracted investment to the area, but at the same time new law is a threat for small traditional shops which risk disappearing being unable to pay high renewed rents. This happened, for example, on Rua dos Douradores, where part of the buildings is destined to be a four-star hotel (hotel Intercontinental), so shops and other enterprises based there (some of them are more than 100 years old) are to be closed. Old rents that were paid before the law were not enough to repair the building, whereas with new law rehabilitation projects can be implemented with much ease. It can potentially ameliorate general look of the area, however, it also results in closure of typical old shops and restaurants, which are replaced by luxury hotels or boutiques.

Due to specific characteristics of this zone, it is in fact evident that area is unlikely to be purely residential, so more complex future vision of Baixa should be pondered. Current development of Baixa area is inserted in the logic of polycentric city, which aims to build urban development upon different “poles”, each having its own specification but assuming multiple functionalities (multifunctional poles) at the same time. In this context, Baixa is seen as a place capable of attracting creative class. Logically, Baixa was chosen as a site for MUDE (Museu do Design e da Moda) and first business incubator in the city “StartUp Lisboa”.

In 2006 City Hall of Lisbon elaborated a strategy for revitalization of Baixa-Chiado area. The process was based on three core ideas: providing space for commercial and leisure activities, transforming the area into a pole of attraction for firms and creative industries and, finally, creating conditions for residential use of the area, superating (преодолевая) mobility limitations and encouraging retail trade. Same document highlights the necessity to reduce through traffic in Baixa, giving absolute priority to pedestrians as a condition of reducing air and noise pollution and improving the

¹⁰³ Braga, I. (2013) A Baixa de Lisboa está a mudar de rosto

environment. This goal should also be achieved by promoting cycling and use of electric vehicles.

The same resolution stresses the importance of making Praça do Comércio more people-friendly and limiting vehicular traffic, in particular through traffic between Cais do Sodre and Campo das Cebolas and traffic flow to and from the North via Praça do Comércio. These measures are to be accompanied by promoting cycling and pedestrian flow along the river bank.

In regard to this, it is important to mention a research named “Lisbon: mobility challenge”, elaborated by Lisbon City Council in 2005, that stipulates basic principles of pedestrian networks in the city. The document is highlighting the importance of an hierarchy of pedestrian routes in inner neighborhoods. For each position of a street in this hierarchy different physical measures to clarify pedestrian priority should be implemented. Another concern is to carefully design pedestrian crossings, considering the routes desired by pedestrians, visibility and braking distance. It is also recommended to properly mark pedestrian walkways by appropriate street signs in areas of high passenger flow (like train stations). Besides, it is advised to encourage firms and other institutions to promote sustainable transportation modes, including walking.

In 2009 proposal made by Lisbon City Council considered a set of measures aimed to meliorate walking environment in the area. It was recommended that traffic lights in Baixa should be gradually turned into passageways where pedestrians have priority, besides, all streets in Baixa are expected to have speed limit of 30 km/h accompanied by traffic calming measures. Imposing speed limits is viewed as a way to protect and preserve the area, making streets quieter and more people-friendly. In 2011 Lisbon City Council adopted a plan for preservation of Baixa, which imposed the introduction of 30 km/h speed limit on Rua da Prata, Rua do Áurea, Praça D. Pedro IV (Rossio), Rua da Conceição, Rua dos Fanqueiros, Praça de Figueira and Rua da Madalena. So far, 30 km/h speed limit signs are installed on Rossio, Praça da Figueira, Rua da Conceição, Rua do Comércio, Rua Áurea, Rua da Prata, Rua dos Fanqueiros.

Also, it is important to guarantee continuity of pedestrian routes on Rua Augusta, coming from Rossio to Cais das Colunas which is now fragmented by vehicular traffic and traffic lights. The need to encourage pedestrian priority on zebra crossings between Arco do Triunfo and Praça de Comércio is explained by the fact that three major monuments, (Arco do Triunfo, Estátua Real e Cais das Colunas) are situated on one axis and form a “line”, thus providing continuous pedestrian route to them will improve security and comfort of pedestrians.

Nowadays there is much polemics about future of traffic in the area. Currently Lisbon’s city council is willing to cut thorough traffic in Baixa, as it is estimated that 70%¹⁰⁴ of vehicles do not have Baixa as their destination or origin. However, half of these 70% is going to or from adjacent to Baixa zones, like Chiado, Santa Apolónia, etc., so eventually this traffic flow is somewhat connected to Baixa. Total number of vehicles during peak periods is approximately 5500 cars per hour¹⁰⁵, with 42%¹⁰⁶ of all trips being made by people going to and from work. As 70% of vehicles are thorough traffic, they may be diverted from Baixa, what will require infrastructural developments. Despite the fact that City Council’s initiatives do not affect those who go to Baixa for a reason, part of local shop owners (from Rua Áurea in particular) fears that diverting traffic from Baixa will have strongly negative consequences on commerce¹⁰⁷. It is true that some structural changes in the street commerce were observed. Pedestrian streets are not suitable for shops that require delivery service (like furniture shops or shops with wedding dresses), so these were slowly disappearing from the streets, giving place to big department stores. Another category is luxury boutiques and jewelry shops whose clients prefer to use private vehicle.

In relation to commercial revitalization, streets of Vitória and Santa Justa were considered promising since they connect Baixa to Chiado and Castelo, thus always having

¹⁰⁴ RTP (2009) ACP pode pedir impugnação judicial sobre corte de tráfego na Baixa

¹⁰⁵ Baixa de Lisboa vai continuar aberta ao trânsito (2009)

¹⁰⁶ Meirinhos, V. (2011) Mobilidade Metropolitana: níveis de motorização e padrões de sinistralidade pedonal da cidade de Lisboa, p. 6

¹⁰⁷ LUSA (2009) Comerciantes da Baixa de Lisboa discordam do encerramento ao trânsito

significant number of visitors. Due to this factor both streets were later transformed into full pedestrian malls.

Through traffic in Baixa also resulted in poor air quality. Levels of emissions on the axis Baixa-Avenida da Liberdade were surpassing national and European legislation, what eventually led to a process in European Justice Court against Portuguese state in 2011. In order to address the problem of pollution, low emission zones were introduced in central city areas, including Baixa, prohibiting circulation of vehicles produced before 1992. These rules were later enforced by prohibiting vehicles produced before 1996 in Baixa and on Avenida da Liberdade. Recently, it has been decided to continue further with the politics of low emission zones, banning the circulation of cars made after 2000¹⁰⁸. This step was based on the research which evidenced that after zones implementation particulates decreased by 20% and NO₂ emissions were reduced by 8% in two-year period (2011-2012)¹⁰⁹. After introduction of new rules these pollutants are expected to decrease by 30% and 20% correspondingly.

4.3. Proposals for Rua Áurea

In spite of having full pedestrian malls in the area and pleasant pedestrian environment in general, streets of Baixa are sometimes source of tensions between motorized vehicles and pedestrians. Together with Rossio and Largo Luís de Camões, streets of Baixa are considered as critical in the number of accidents on traffic lights involving pedestrians. Between 2004 and 2011 in total 3921 people were knocked down in these areas, in 2010-2011 this number was 1294¹¹⁰. Most accidents (28%) occurred when

¹⁰⁸ Boaventura, I. (2014) Veículos anteriores a 2000 proibidos de circular na Baixa de Lisboa a partir de Novembro

¹⁰⁹ Boaventura, I. (2014) Veículos anteriores a 2000 proibidos de circular na Baixa de Lisboa a partir de Novembro

¹¹⁰ Alemão, S. (2013) A ousadia de andar a pé em Lisboa

pedestrians were jaywalking, 24% occurred on zebra crossing and 14% were cases when pedestrians were walking along the street without crossing it. Also it is important to note the majority of accidents occurred in the distance of less than 50 meters away from zebra crossing.

Concerning pedestrian facilities in Lisbon and in Baixa in particular, there is a number of difficulties which complicates walking:

1. Sometimes straight streets lacking traffic calming measures encourage drivers to go over speed limit, making pedestrian environment hostile
2. Another concern is the position of some traffic lights, which is uncomfortable for pedestrians so they eventually cross the street where they find it more convenient
3. Quality of sidewalks is also an important issue, as often pedestrians end up walking on motorway because sidewalk is not comfortable for walking. The reason for this may be inadequate width of a sidewalk, so basically it is not able to accommodate big pedestrian flow
4. Quality of sidewalk surface in certain cases is quite poor and people prefer motorway which is plain and not so slippery as *calçada portuguesa*
5. Illegal parking on sidewalks continues to be a problem in Baixa
6. Street furniture (traffic signs, trash bins, tables and chairs of close restaurants) installed on already narrow sidewalks leaves almost no space for pedestrian passage
7. Poor lighting and little presence of other people in night hours on some streets, discouraging pedestrians from using certain route due to the feeling of danger (R. Douradores/R. Sapateiros)

Shared space concept may be a solution to some of these problems, so in order to better develop this scenario a field work was carried out on Rua Áurea. This street is one of the busiest in Baixa as it is opened to traffic, served by public transport (located very

close to Baixa-Chiado metro station) but at the same time is crossing all pedestrian streets with orientation East-West, and these are Rua de Santa Justa, Rua de Assunção, Rua da Vitória and Rua de São Nicolau. Thus, Rua Áurea is highly procured by drivers, public transport users and pedestrians, aggregating large numbers of people from each category during the rush hour.

Apart from being crucially important for the citizens as a transit line, the street also hosts numerous commercial sites, like H&M department store, hostels, banks and provides access to Armazéns do Chiado.

At the same time, problems indicated above which are common for streets in Baixa, are, naturally, present on Rua Áurea. It is a straight street so its natural layout encourages speeding. Traffic lights, installed on 9 pedestrian crossings, aim to prevent this. On the intersections with pedestrian streets zebra crossings are made to be accessible for people with reduced mobility (raised pedestrian crossings or inclined ramps are in place).

Zebra crossings are located on the intersection of Rua Áurea with streets going in East-West direction. Generally, the location of pedestrian crossings is well chosen, as there are large numbers of people who cross Rua Áurea, coming from streets perpendicular to it, who simply need to cross Rua Áurea and continue their itinerary without actually walking on Rua Áurea (for example, people going to Baixa-Chiado metro station from Rua da Vitória). However, jaywalking is still a very common thing on the street, even though pedestrian crossings are numerous. On the stretch between Rossio and Rua da Conceição zebra crossings are placed each 100 meters, whereas between Rua da Conceição and Praça do Comércio this distance shortens to 50-70 meters. Total length of the street is about 710 meters. Length of a segment where Rua Áurea connects with pedestrian streets is approximately 500 meters.

Observations were made along the whole length of the street, starting from Rossio until Praça do Comércio. Observations were made during morning and evening peak-hours, since during this time road situation is more complicated and large pedestrian

flows and traffic flows are present. Analyzing road situation in these extreme conditions provides for better understanding of complexity of mobility problems. The idea was to see how the street is being used by all users, but in particular, by pedestrians, how they move around the street and cross it, if they follow the rules or not really and if conflicts between pedestrians and drivers occur frequently or they manage to reconcile their interests.

The results of the observations may be seen in the table below. Cases of jaywalking in the area were divided into 3 categories:

- jaywalking while vehicles were moving/passing by;
- jaywalking while traffic was stopped on the traffic lights;
- jaywalking on pedestrian crossings;

JAYWALKING ON RUA ÁUREA IN PEAK HOURS

Segment	Active traffic	No traffic	Date/Time
Rossio – Rua Sta Justa	27	112	19 Set 18:00 – 18:30
Rua Sta Justa – Rua da Assunção	32	52	22 Set 18:30 – 19:00
Rua da Assunção – Rua da Vitória	23	26	23 Set 8:30 – 9:00
Rua da Vitória – Rua da Conceição	16	51	23 Set 9:00 – 9:30
Rua da Conceição – Rua de S. Julião	9	43	26 Set 17:00 – 17:30
Rua de S. Julião – Praça de Comércio	47	46	26 Set 17:30 – 18:00
Total:	154	330	3 hours

To sum up, there were in total 484 cases of jaywalking between crosswalks on Rua Áurea in peak hours.

Concerning non-peak hours, the following results have been obtained on the segment which is proposed for shared space:

JAYWALKIN BETWEEN ROSSIO AND RUA DA CONCEIÇÃO IN NON-PEAK HOURS

Segment	Active traffic	No traffic	Date/Time
Rossio – Rua Sta Justa	6	25	6 Nov 12:10 – 12:25
Rua Sta Justa – Rua da Assunção	8	19	6 Nov 12:30 – 12:45
Rua da Assunção – Rua da Vitória	13	20	6 Nov 14:00 – 14:15
Rua da Vitória – Rua de São Nicolau	6	28	10 Nov 12:20 – 12:35
Rua de São Nicolau – Rua da Conceição	9	18	10 Nov 12:40 – 12:55
Total:	42	110	1 hour 15 minutes

Summarizing, in non-peak hours there were 152 cases of jaywalking between zebra crossings on Rua Áurea in approximately one hour.

Concerning jaywalking on crosswalks, there were 423 cases registered during peak-hours on the whole length of a street. The majority of cases was registered on the first crosswalk from Rossio square. In peak-hour on a working day 178 cases were registered in 15 minutes. Not in peak-hour this figure went down to 101 cases. However, there are much more people who actually wait for green light on this intersection, in non-peak hour there were 261 people waiting for it. Thus the number of jaywalkers on this pedestrian crossing is more than two times lower compared to the number of those who obey the rules, so traffic lights there are very functional and are being used correctly, what makes their elimination unwise. In non-peak hours jaywalking on pedestrian crossings between Rossio and Rua da Conceição was observed in total in 206 cases in 1 hour and 15 minutes. In general, it has been noted that people are more likely to jaywalk on pedestrian crossing if there is significant number (around seven) of people willing to cross as well. The

majority of those who cross Rua Áurea on crosswalks do not actually have Rua Áurea as destination, but moreover continue to walk on the street which they came from. In other words, a person who crosses Rua Áurea coming from Rua Vitória is likely to continue walking on Rua Vitória rather than changing to Rua Áurea.

It was noted that, on the contrary to jaywalkers on crosswalks, people who cross the street where there is no zebra crossing are actually using services that the street is offering. For example, a person who is walking on Rua Áurea and sees an interesting shop on the other side is likely to cross the street in that place, in order to save time and get faster to the shop, rather than going to the nearest crosswalk. It is also very common for people working on the street (like waiters from cafeterias or workers of catering service) to cross it where they like. Still, most people prefer to wait for the traffic to stop at the nearest traffic lights and cross the street when there are no vehicles moving, so they are concerned about safety, but probably think it is faster to wait for the traffic to stop and then cross the street in inappropriate place rather than go to the crosswalk. So, the fact that crosswalks are located quite close to each other (100 meters distance) does not stop people from jaywalking on the street.

It should be noted that no typical “portrait” of a jaywalker was observed. Basically, the composition of jaywalkers is very diversified, so it can be aged people or young, people in groups or individually, mothers with kids, tourists, etc. There were only two conflicts between jaywalkers and vehicles registered during the study, and both were not serious (just a driver signaling to jaywalker). Probably, this is due to the fact that medium speed in Baixa in rush hours is approximately 23-24 km/h¹¹¹, so this speed allows preventing serious accidents.

Taking these factors into consideration, it seems that Rua Áurea might be an appropriate site for shared space implementation. Currently the street already functions almost as a shared space, with people crossing the street where they like and average speed being close to the speed limit of 20 km/h typical for woonerf.

¹¹¹ Câmara Municipal de Lisboa (2005) Lisboa: o Desafio da Mobilidade, p. 161

Eliminating traffic lights and traffic signs could improve visual aspect of the street, giving more space to pedestrian flow. Besides, in rush hours the number of people on sidewalks is so big that many people choose to walk on the road surface as there is not much space (especially when there are construction works on the site) or if they want to overtake other pedestrians. With implementation of shared space it is possible to adjust street layout to compensate for sometimes insufficient width of a sidewalk, also alerting the drivers about people walking close to the motorway. As it has been mentioned above, 14% of all accidents in the area involve people going along the street on a motorway. As it has been mentioned above, drivers tend to drive with more caution in shared space, paying more attention to other street users, so it is possible that this concept, implemented on Rua Áurea, would encourage drivers to act according to the situation rather than just following traffic signs, which are, probably, not so functional on this street as many pedestrians ignore them. Basically, there seems to be compliance with traffic rules from the part of vehicles, but not from the part of pedestrians.

In addition to that, it is important to keep in mind that from Rossio until Rua Conceição streets that cross Rua Áurea are pedestrianized, so shared space with low speed limit would guarantee more harmonized transition from pedestrian street to street opened to traffic. Besides, it would give more continuity to the site in general, connecting Rua Áurea with pedestrian environment of neighboring streets.

Shared space on Rua Áurea could also improve visual appearance of a street if appropriate urban design is applied, for example, concerning road pavement. Since in shared space curbs are often eliminated and borders between motorway and sidewalks, which are on the same level, are more intuitive, some experiments with road pavement might be put in place.

For example, road pavement design might be associated with pavement on Praça do Comércio, connecting visually the street and the square:

SHARED SPACE ON RUA ÁUREA

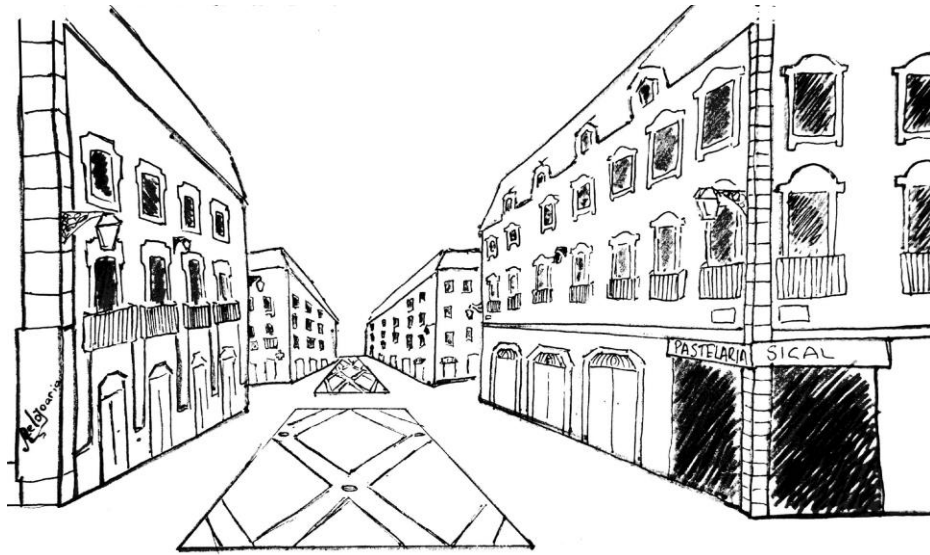


Image source: author

Road pavement might help to better understand the essence of shared space as lines crossing each other create an impression of a common area and in a certain way illustrate different street users crossing the street the way they like.

Associating street pavement to maritime patterns may also be an option, as the city is strongly connected to water and the sea, besides, the street leads to the river bank. The idea of a common space which people cross freely is demonstrated in wave-like lines.



Image source: author

However, there are certain difficulties in applying the shared space model to Rua Áurea:

1. It is important to understand that linear structure of a street would demand implementation of traffic calming measures, in particular, raised pavement on intersections of Rua Áurea with pedestrian streets. Such speed humps would ease walking and street crossing for disabled people, at the same time forcing the drivers to slow down. Without traffic calming measures it is very probable that drivers would speed up and overpass the 20 km/h limit.

2. Another problem is intersections of Rua Áurea with streets opened to traffic (from Rua da Conceição until Praça do Comércio). At this section, shared space might seriously complicate traffic situation as there are many users (pedestrians, public transport, private vehicles, cyclists) coming in different directions. So introduction of shared space on a section where Rua Áurea intersects with pedestrian streets seems to be easier, at least as a trial attempt.

3. The problem of emissions should also be tackled as speed limit of 20 km/h may provoke increase in pollutants produced on lower speeds. However, noise pollution is likely to decrease as vehicles will drive more slowly

To sum up, it seems that informal shared space is already working on Rua Áurea, as people tend to cross it where they like, but at the same time they pay attention to vehicles, normally waiting for them to stop or drive slowly. Shared space design could adjust the street to the way it is used nowadays, favoring slow speeds and easing pedestrian circulation. Still, there are some issues which should be considered concerning this idea, in particular, the problem of intersections between Rua Áurea and other streets opened to traffic. In these conditions, it is likely that shared space might complicate traffic circulation. Still, on the stretch between Rossio and Rua da Conceição, shared space could improve walking facilities and visual appearance of the street.

CONCLUSION

Rapid and extreme growth of automobile use caused problems in cities, namely pollution, congestion and poor quality of urban environment. Old town centers were not able to accommodate large traffic flows. However, proper distribution of goods and individuals is an important condition of successful economic performance of a city.

Post-war urban developments were largely oriented to serve the needs of vehicular traffic, so wider roads and parking facilities were considered essential. At the same time, car was becoming more and more accessible for large population groups and, naturally, people preferred locations which would assure comfort during driving. This trend and consequent infrastructure projects changed urban life. Historical centers turned out to be poorly prepared for large traffic flows, so going there started to be a problem, harming functioning of a whole system. At a certain moment, attributing different functions to urban roads in accordance with their capability and location seemed like a logical solution as abundant traffic in some areas was rather causing problems than solving accessibility issues. Besides, sometimes heavy traffic was in a way dissuading people from going out on the streets, so limitations on traffic circulation was a way of street reclaiming, of giving street back to people and not to vehicles. Naturally, this is not justified in certain cases (for example, on major transportation axis), where traffic circulation is responsible for supplies of goods and transporting passengers. On other arteries, though, limiting or cutting full traffic flow may bring a number of benefits, like increased levels of walking and cycling, de-congestion of streets, pleasant environment, commercial attractiveness and lower levels of pollution. These indicators vary depending on each case in particular, however, pedestrianization of historical city center has become a common practice, generally welcomed by local population.

Full pedestrian malls on narrow streets of European cities have become vivid commercial areas and attract large number of tourists. Still, full pedestrianization may be inappropriate for some areas, either due to their predominantly residential function or

relevant role in urban mobility. Imposing speed limits of 20 km/h and 30km/h may contribute to higher safety levels on streets and less noise pollution at the same time improving overall impression from an area.

The area of Baixa, in central Lisbon, is an interesting example of pedestrianization project. It is in a way “classic” scenario as Baixa suffered from similar problems as many European cities, like congestion, lack of parking facilities, general decay as urban sprawl was growing. There are, though, some particularities in the case of Baixa, and, first of all, it is the geometrical layout of the area, revolutionary for the times when it was built.

Nowadays, pedestrian precinct in Baixa includes central street of Rua Augusta and a number of additional streets, forming a network of pedestrian malls. Streets opened for through traffic (Rua Áurea, Rua dos Fanqueiros, Rua da Prata and Rua da Conceição) frame the pedestrian zone. Thus, Rua Augusta is situated on the limit of pedestrian precinct, and is crossed by a number of pedestrian streets, so is characterized by significant pedestrian flow. Simultaneously, it accommodates numerous commercial and public institutions, as well as many cafes with street terraces. Still, the presence of vehicles on the street is quite noticeable, but people tend to cross it wherever they like, guaranteeing safe passage by maintain eye contact with drivers. Certain features of this street presume that it could be transformed into shared space zone, thus performing a role of a transition zone between full pedestrian malls and streets opened to traffic.

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